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Oral Presentation Abstracts

Mixed-Methods Systematic Review to Identify Barriers and Facilitators Associated With Physical Activity Among Children and Adolescents in the Gulf Region

Alsulami, H.*, McNarry, M.A., Petrie, F., & Mackintosh, K.A.

**Applied Sports, Technology, Exercise and Medicine Research Centre, Swansea University, UK. 2237453@swansea.ac.uk*

INTRODUCTION: Physical activity (PA) is associated with numerous health benefits. Research has shown low PA levels across all age groups in Gulf Cooperation Council (GCC) countries. The aim of this systematic review was to identify and synthesise the barriers and facilitators to PA for children and adolescents in GCC countries. **METHODS:** A systematic search of relevant literature published before June 2023 was conducted through CINAHL, Ebsco, Coherence library, PubMed Central, Scopus, Web of Science, SPORTDiscus (EBSCOhost) and Google Scholar. Following the removal of 475 duplicates, two independent researchers screened 3,412 titles and abstracts and, subsequently, 13 full texts. Six studies met the inclusion criteria, the quality of which was assessed using the Mixed Methods Appraisal Tool. A socio-ecological model was used to guide the narrative. **RESULTS:** Individual-level barriers included lack of time and/or energy, the cost of using sports facilities, and participants' attitudes toward PA. At the interpersonal and organisation levels, parental and peer support and lack of time due to academic responsibilities negatively impacted children and adolescents' PA perceptions. Moreover, high temperatures were a key barrier to outdoor PA. Cultural norms played an important role in discouraging girls from engaging in PA in open areas, whilst accessibility of facilities and lack of sports spaces in neighbourhoods and built environments influenced children and adolescents' PA perceptions at the community level. **CONCLUSION:** This review has identified the barriers faced by the adolescents in the GCC countries that affect their PA levels at multiple levels of influence. Intrapersonal, interpersonal, communal, and environmental factors negatively affect youth PA, particularly females. This systematic review has also shown that sex-specific factors must be considered in the development of future interventions.

Association of Device-Measured Physical Activity and Sedentary With Exercise Capacity and Quality of Life Among Adolescents With Congenital Heart Disease

Amir, N.H.*, Forsythe, L., Dorobantu, D.M., Wadey, C.A., Caputo, M., Pielles, G.E., Stuart, A.G. & Williams, C.A.

**Department of Translational Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK; Faculty of Sports Science and*

Recreation, Universiti Teknologi MARA Cawangan Perlis, Kampus Arau, Perlis, Malaysia. nurul.amir@bristol.ac.uk

INTRODUCTION: Patients with congenital heart disease (CHD) typically exhibit reduced exercise capacity and life quality, even after their structural heart defects have been clinically corrected. However, little is known about the interactions between physical activity (PA), sedentary time (ST), exercise capacity (peak VO_2) and health-related quality of life (HRQoL) in adolescents with CHD. The aim of the study was to assess the associations between device-measured PA, ST, peak VO_2 and HRQoL among adolescents with CHD. **METHODS:** 28 adolescents with CHD (mean age 14.4 ± 1.7 y, 57% male) were recruited. PA (total PA and MVPA) and ST were measured using a GENEActiv accelerometer for 7-consecutive days, with data analysed if wear time was ≥ 16 hours/day and ≥ 4 days using age-specific cut-offs by Phillips (2013). Peak VO_2 via an incremental cycle ramp test and HRQoL using a self-reported Teens (12-18 years) Paediatric Quality of Life Inventory Questionnaire were assessed. Linear and multiple regression were used to examine the association between all variables. **RESULTS:** Mean total PA, MVPA and ST were 223.3 ± 65.0 , 57.0 ± 28.2 , and $763.0 \pm 105.4 \text{ min} \cdot \text{d}^{-1}$, respectively. Mean peak VO_2 was $31.6 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ and HRQoL overall score was 71.6/100. Total PA and MVPA were positively associated with peak VO_2 with, $\beta=0.1, P=0.02$ and $\beta=0.2, P=0.001$, respectively. MVPA demonstrated a positive association with overall HRQoL ($\beta=0.2, P=0.04$) whereas total PA did not ($\beta=0.04, P=0.28$). ST was neither associated with peak VO_2 ($\beta=-0.02, P=0.24$) nor HRQoL ($\beta=-0.02, P=0.43$). Total PA, MVPA and ST were not associated to any HRQoL sub-components. MVPA and HRQoL explained 39% of the variability in predicting peak VO_2 . MVPA was associated to peak VO_2 ($\beta=0.15, P=0.01$) but once HRQoL was controlled the association was no longer significant ($\beta=0.19, P=0.15$). **CONCLUSIONS:** Participants with higher levels of PA were linked to better life quality. However, this link was impacted by peak VO_2 , indicating that peak VO_2 plays a role in the connection between PA and life quality.

Sex Differences in Signal Response Before and After the Ventilatory Threshold Using Signal Variability Comparative Analysis of Healthy Children

Bar-Yoseph, R.*, Blanks, Z., Cooper, D.M., Radom-Aizik, S. & Brown, D.E.

**University of California Irvine, Pediatric Exercise and Genomics Research Center, Department of Pediatrics: Ruth's Children's Hospital, Pediatric Pulmonary Institute, Rambam Health Care Campus. r_bar-yoseph@rhc.gov.il*

INTRODUCTION: Cardiopulmonary exercise testing (CPET) involves breath-by-breath measurement of gas exchange and continuous heart rate (HR). We applied data science signal analytic approaches, sample entropy, in novel ways to the rich and often ignored data collected throughout the

CPET protocol. This permitted us to gain insight into physiologic system complexity associated with exercise by considering response uncertainty and variability. Specifically, we wondered whether the work rate (WR) intensity altered sample entropy of gas exchange and HR during progressive CPET. **METHODS:** Eighty-nine healthy children (46 F and 43 M) performed CPET on a cycle ergometer to the limit of their tolerance. Sample entropy of the resulting $\dot{V}O_2$ signal before and after the ventilatory threshold (VT) was calculated. We ensured the $\dot{V}O_2$ signal was weakly stationary by removing the trend via a thermodynamic WR-based Gaussian process, and selected an appropriate radial distance via a cyclic block bootstrap heuristic to account for shorter than standard signal lengths. **RESULTS:** Using a Bayesian hierarchical t-test, we found that entropy of breath-by-breath $\dot{V}O_2$ decreased by $5.5 \pm 2.8\%$ ($p=0.028$) after the VT in males and by $5.2 \pm 2.4\%$ ($p=0.015$) in females. Before the VT, early-pubertal males had $9.9 \pm 4.9\%$ ($p=0.021$) higher entropy than late-pubertal males, and early-pubertal females had $8.5 \pm 3.3\%$ ($p=0.005$) higher entropy than late-pubertal females. Comparing between sexes, females exhibited slightly higher entropy (1.9% and 2.3% before and after the VT) and lower variance (28.1% and 4.6%) but these differences were not significant. **CONCLUSION:** Lower entropy in response to increasing workloads beyond a known threshold may represent a physiological adaptation to maintain homeostasis under stressful conditions. Using sample entropy to gauge signal predictability may add an approach to elucidating the physiological mechanisms that govern the systemic response to the stress of physical exercise.

16 Weeks of Physically Active Mathematics and English Language Lessons Improves Cognitive Function and Gross Motor Skills in Children Aged 8–9 Years

Boat, R.*, Cooper, S.B., Carlevaro, F., Magno, F., Bardaglio, G., Musella, G. & Magistro, D.

*Department of Sport Science, School of Science and Technology, Nottingham Trent University (United Kingdom). ruth.boat@ntu.ac.uk

INTRODUCTION: It is well-documented that many young people do not meet the recommended 60 min of moderate to vigorous physical activity per day (Aubert et al., 2021). To address this issue, it has been proposed that schools are a key intervention target for increasing physical activity (van Sluijs et al., 2021). However, due to the focus of the education sector primarily on educational outcomes, opportunities for physical activity are often reduced. One potential way to maximize time for academic subjects alongside physical activity is their combination within the classroom, typically referred to as physically active lessons. This study examined the effects of physically active lessons, implemented through the Mathematics and English Language curriculum, on cognitive function and gross motor skill development. **METHODS:** 192 children aged 8–9 years were randomly allocated to an intervention group ($n=98$) or a control group ($n=94$). The intervention consisted of 8 h.wk⁻¹ of physically active lessons, equally split between Mathematics and English Language, for 16 weeks. Cognitive function (digit span, coding, arithmetic reasoning) and gross motor skill development (TGMD-3) were assessed at baseline and follow-up. **RESULTS:** Two-way mixed method (group (intervention vs. control) by time (time 1 and 2)) ANOVAs revealed that the improvement in every domain of cognitive function was greater in the intervention group compared to the control group (group * time, $p=0.008$ – 0.023 , $d=0.34$ – 0.42). Furthermore, total TGMD-3 score (group * time, $p<0.001$, $d=1.16$) and both sub-scales (locomotor, $p<0.001$, $d=0.63$; object control, $p<0.001$, $d=1.29$) also improved by a greater extent in the intervention group than in the control group. **CONCLUSION:** The findings suggest that 16 weeks of physically active lessons, taught in

both Mathematics and English Language curriculum, synergistically improved cognitive function and gross motor skill development in primary school children.

Oxygen Pulse During Exercise in Children With a Chronic Inflammatory Disease and Healthy Controls

Byra, M.M.*, Da Silva, S., Chen, S.R., MacDonald, M.J., Cellucci, T., Thabane, L., Timmons, B.W. & Obeid, J.

*Child Health & Exercise Medicine Program, McMaster University, Hamilton, ON L8S 4K1, Canada. byram@mcmaster.ca

INTRODUCTION: Oxygen pulse measured during exercise provides a non-invasive estimate of the stroke volume response to physical exertion. Adults with early cardiovascular disease progression, children with congenital heart disease, and children with type 2 diabetes demonstrate a blunted oxygen pulse response to exercise compared to healthy controls. No study to date has examined oxygen pulse during exercise in children with a chronic inflammatory disease (CID) who may have an increased risk of poor cardiovascular health outcomes. Therefore, the aim of this study was to compare oxygen pulse at different exercise intensities in children with a CID and healthy controls. **METHODS:** Children aged 7 to 17 years with a single diagnosis of a CID and healthy controls with no diagnosed or suspected medical conditions completed a cardiopulmonary exercise test on a cycle ergometer. Oxygen uptake was measured breath-by-breath on a calibrated metabolic cart, and heart rate was noted every minute. Oxygen pulse was calculated by dividing volume of oxygen uptake (VO_2) by heart rate at rest, 25%, 50%, 75%, and 100% of VO_{2peak} . Group differences were examined using ANCOVAs, controlling for resting oxygen pulse. **RESULTS:** Ninety-one participants with a CID (55% girls, mean \pm SD, age: 13.1 ± 2.8 years) and 17 healthy control participants (35% girls, mean \pm SD, age: 13.7 ± 2.3 years) completed this study. Resting oxygen pulse was significantly lower in children with a CID (3.64 ± 0.97 mL/beat) compared to healthy controls (4.75 ± 2.19 mL/beat; $F(1,104)=11.48$, $p=0.001$), and trended towards being lower in CID vs. controls at 75% VO_{2peak} (9.84 ± 2.70 vs. 12.13 ± 2.74 mL/beat; $F(2, 89)=2.78$, $p=0.098$) and 100% VO_{2peak} (10.68 ± 2.97 vs. 13.45 ± 3.32 mL/beat; $F(2,89)=3.79$ $p=0.055$). **CONCLUSION:** Our findings suggest that cardiovascular function may be altered in children with a CID. Future research should examine the link between oxygen pulse and other markers of cardiovascular health in children with a CID.

Did Children and Youth's Movement Behaviours Differ by Phases and Geographic Region During COVID-19? A Repeated Cross-Sectional Study With Spatial Analysis in Nova Scotia, Canada

Campbell, J.E.*, Stone, M.R., Mitra, R., Rehman, L., Kirk, S.F.L., Faulkner, G., Tremblay, M.S. & Moore, S.A.

*School of Health and Human Performance, Dalhousie University, Halifax, Canada. julie.campbell@dal.ca

INTRODUCTION: The COVID-19 pandemic had a significant impact on the health of children, particularly as it related to their physical activity, screen time, and sleep (collectively known as movement behaviours). Restrictions imposed during the pandemic, such as limited access to the outdoors, schools, and public green spaces, varied over time and by geographic location, potentially affecting movement behaviours differently. This study aimed to investigate the impact of the COVID-19 pandemic on the movement behaviours of children living in Nova Scotia (NS), Canada, over time and across different geographical regions.

METHODS: Secondary data from three repeated cross-sectional surveys were analyzed, and parent-reported demographic, movement, and geographic data over time of 291 children aged 5-17 years were summarized. Spatial cluster analysis was used to identify geographic concentrations of children living in NS who were more or less likely to meet moderate-vigorous PA (MVPA) guidelines during the pandemic. **RESULTS:** The study found that only 5.5% of children and youth were meeting the combined 24-hour movement behaviour guidelines throughout the pandemic. Of the movement behaviours, screen time differed across the pandemic and by age and gender. Spatial analysis identified clusters of children and youth meeting the MVPA recommendation on fewer days concentrated in areas within the three largest population centres (Truro, Sydney, and the Halifax Regional Municipality (HRM)) in NS, and clusters of those meeting the MVPA recommendation on more days were also identified in the HRM. **CONCLUSIONS:** Overall, fewer public health restrictions led to more favorable movement behaviours during the COVID-19 pandemic. Sociodemographic and spatial factors may have contributed to disparities in healthy movement across the pandemic. Policymakers should consider these factors when identifying strategies to promote activity among children and youth during future health crises.

The Impact of Movement Behaviours on Rate Pressure Product in Children and Adolescents

Carvalhinho Silva, A.*, Estima, F., Lagoa, M.J., Aires, L. & Silva, G.

*Research Centre in Sports Sciences, Health Sciences and Human Development (CIDESD), University of Maia (UMAia). acarvalhinho@umaia.pt

INTRODUCTION: To study associations between rate-pressure product (RPP) with sedentary behaviours (SB), physical activity (PA), and sleep. **METHODS:** A cross-sectional observational study was conducted with 843 children and adolescents (10-18 years old). All predictor variables were recoded to binary categorical variable: Body Mass Index (BMI) – normal-weight/overweight; PACER test -fit/unfit- to measure aerobic capacity; Sleep - ±8h - was measured by The Pittsburgh Sleep Quality Index (PSQI); SB was measured by questionnaire, estimating daily time (h) spent in personal computers for study (PCS) and leisure (PCL), tablets, smartphones (SPH), social networks (SN), watching television (TV), and screening time – +2h - and sitting (ST) - +8h. Systolic (SBP) and diastolic (DBP) blood pressure were measured using a portable sphygmomanometer (M4 Intelli IT, OMRON). The outcome variable, RPP, was calculated by multiplying resting heart rate and SBP, classified by 10.000 mmHg*bpm cut-off. The associations between RPP and PA, SB, and sleep were analysed using Chi-square and multiple logistic regressions (stepwise method). All statistical analyses were performed in SPSS with a significance level set at 5% ($p < 0.05$). **RESULTS:** Overweight showed a $\chi^2(1, N=843) = 15.34, p < 0.001$ and an OR=1.933, $p < 0.001$, while unfit showed a $\chi^2(1, N=703) = 22.42, p < 0.001$ and an OR=2.389, $p < 0.001$, in the association with increased RPP. When both were associated together, overweight showed an OR=1.647, $p = 0.015$, while unfit showed an OR=2.108, $p = 0.015$, in the association with increased RPP. No associations were found between RPP, SB, and sleep variables. **CONCLUSIONS:** Unfit or overweight children and adolescents showed more chances to have higher RPP than fit and normal-weight peers.

Comparison of the Effect of Sports Practice in Childhood and Adolescence on Cardiac Autonomic Modulation in Adults: A Retrospective Study

Christofaro, D.G.D.*, Tebar, W.R., Delfino, L.D., Santos, A.B., Saraiva, B.T.C., Vanderlei, L.C.M., Fernandes, R.A. & Mota, J.

*São Paulo State University (Unesp), School of Technology and Sciences, Presidente Prudente; Brazil. diego.christofaro@unesp.br

INTRODUCTION: Cardiac autonomic modulation (CAM) is an important cardiovascular marker, however low values of CAM have been associated with higher chances of mortality. In this sense, healthy lifestyle habits may be associated with higher CAM values, among which physical activity through sports practice is one of them. However, it is not clear if previous sports practice (in childhood and adolescence) could contribute to greater CAM in adult life. Objective: To compare the CAM according to sports practice in childhood and adolescence. **METHODS:** Two hundred and fifty participants (41.99 years old) from a city in southeastern Brazil participated in the study. Sports practice in childhood and adolescence was assessed by self-report. For analysis, the heart rate was captured beat by beat by a Polar heart monitor, model V800, for 30 minutes with the volunteer at rest and supine position. 1000 beats of the most stable period of the tracing were used to calculate the HRV indices. For CAM were used SDNN, RMSSD, SD1 and SD2 indices. The Analysis of Covariance adjusted for gender, age and socioeconomic status (assessed using a questionnaire) was used to compare MAC according to sports practice in childhood and adolescence. **RESULTS:** Participants who practiced sports in childhood had higher MAC values when compared to non-practitioners; SDNN (50.29 vs 44.58; $P = 0.041$) and SD2 (65.97 vs 58.58; $P = 0.031$), with marginal significance for RMSSD (36.20 vs 29.52; $P = 0.055$), SD1 (25.49 vs 20.92; $P = 0.063$). Similar results were observed for participants who practiced sports during adolescence when compared to non-practitioners; SDNN (49.79 vs 44.29; $P = 0.043$) and SD1 (24.70 vs 21.07; $P = 0.128$), but not significant for RMSSD (35.09 vs 29.71; $P = 0.112$) and SD2 (65.44 vs 58.07; $P = 0.027$). **CONCLUSION:** Participants who practiced sports in childhood and adolescence had a higher global CAM when compared to non-practitioners.

Accelerometer Intensity Gradient and Fragmentation in a Nationally Representative Sample of Children and Adolescents in the United States

Clevenger, K.A.* & McKee, K.L.

*Department of Kinesiology and Health Science, Utah State University, USA. kimberly.clevenger@usu.edu

INTRODUCTION: Children's play includes brief and intermittent physical activity (PA) interspersed with rest. Novel accelerometer-derived outcomes provide a means to move beyond overall PA time and instead, characterize the whole activity profile and its temporal patterns. The present study aimed to characterize PA participation, intensity gradient, and fragmentation metrics in a nationally representative sample of children and adolescents in the United States, and to explore differences by age, sex, weight status, and socioeconomic status. **METHODS:** A representative sample of 3-15-year-olds ($n = 1,361$) in the 2012 National Youth Fitness Survey wore an accelerometer on the non-dominant wrist for one week. Sedentary time, total (light-to-vigorous) PA, moderate-to-vigorous PA, intensity gradient, mean duration of PA bouts, and probabilities of transitioning between inactivity and PA were calculated. Outcomes were compared by age group, sex, socioeconomic status, and weight status while adjusting for covariates and the survey's multistage, probability sampling design. **RESULTS:** Half (50.2%) of participants averaged 60 min of moderate-to-vigorous PA per day. Total (mean=3.2 sec) and moderate-to-vigorous (2.3 sec) PA bouts were short in duration, participants were most likely to transition from moderate-to-vigorous PA to inactivity (probability=45.2%), and mean intensity gradient was -2.4. Adolescents, females, and obese participants had worse activity profiles (i.e., more sedentary time, less moderate-to-vigorous PA, more negative

intensity gradients, more fragmented activity). There were no significant differences by socioeconomic status. **CONCLUSIONS:** We provide preliminary information about typical values for these novel metrics which aim to move beyond overall time spent being (in)active in a representative sample of United States youth. PA-promoting interventions for adolescents, girls, and/or obese youth should find ways to sustain PA (i.e., make it less fragmented).

Relationship Between BMI and Motor Proficiency in Eight-To Nine-Year-Old Children in the North West Province of South Africa: PERF-FIT Study

Coetzee, D.*, Botha, B., Roux, N. & O'Brien, D.

*Physical Activity, Sport and Recreation (PhASRec), Focus Area, Faculty of Health Science, School of Human Movement Sciences, North-West University, Potchefstroom 2531, South Africa. 12129941@nwu.ac.za

INTRODUCTION: Overweight and obese children display lower physical activity levels and below the expected motor performance compared to children of normal weight. Researchers in developed countries report that children with higher BMI scores, displays lower motor performance than their peers. This study aimed to determine the relationship between BMI and motor proficiency in eight- to nine-year-old children. **METHODS:** This cross-sectional study forms part of the PERF-FIT research study. One-hundred and eleven students (eight- and nine-years-old) participated in this study. The Bruininks-Oseretsky Test of Motor Proficiency 2nd Edition Short Form was used to measure the motor proficiency of the children. The BMI was calculated using height in meters and weight in kilograms. A Pearson correlation was used to determine the relationship between BMI and motor abilities, followed by an independent t-test to evaluate any age differences. **RESULTS:** The results indicated a significant statistical negative correlation ($p \leq 0.05$; $r \geq -0.28$) with a small effect between BMI and motor proficiency. Overall, the eight-year-old group obtained a negative correlation with BMI ($r = -0.10$). The nine-year-old group had a strong statistically significant correlation with BMI ($r = 0.62$). A significant difference regarding the following motor skills were reported between the groups: folding paper ($p = 0.006$), copying a square ($p = 0.011$), jumping in place - same sides synchronized ($p = 0.006$), walking forward on a line ($p = 0.005$), standing on one leg on a balance beam eyes open ($p = 0.005$), and the SF total score ($p = 0.052$). **CONCLUSION:** Children of the normal or underweight weight category had better motor skills than those of overweight or obese weight. As a result, early childhood obesity has a negative impact on motor ability development. As a result, physical activity opportunities for children with a higher BMI should be expanded to improve their motor proficiency.

The Daily Mile: Acute and Chronic Effects on Cognitive Functions in Primary School Children

Cooper, S.B.*, Dring, K.J., Hatch, L.M., Williams, R.A., Morris, J.G., Sunderland, C. & Nevill, M.E.

*PANHAL Research Group, SHAPE Research Centre, Department of Sport Science, School of Science and Technology, Nottingham Trent University, UK. simon.cooper@ntu.ac.uk

INTRODUCTION: This presentation will focus on a series of studies conducted by our research group regarding the acute, and chronic, effects of The Daily Mile on children's cognition and health. The Daily Mile is very widely implemented in the UK and across Europe, and has attracted significant investment, despite there being a paucity of scientific evidence supporting its efficacy. **METHODS:** Initially, 104 children completed the Daily Mile and a rested control trial in a randomised order-balanced

crossover design. Cognitive tests were completed pre-, immediately post-, and 45 min post-exercise. There were no statistically significant effects of The Daily Mile on cognition, compared to rest (all $p > 0.05$). However, accuracy on the one-item level of Sternberg paradigm ($p = 0.073$) and complex level of the Stroop test ($p = 0.057$) tended to improve immediately following The Daily Mile, compared to resting. In the second study, 44 children took part in The Daily Mile every day for 5 weeks (intervention group), whilst 35 children continued with their standard activity (control group). Cognitive tests were completed, at rest, pre- and post- the intervention period. **RESULTS:** Cognition was unaffected (all $p > 0.05$), with the exception of response times on the complex level of the Stroop test where the intervention group (1357ms, 95% CI [1280ms, 1400ms]) were significantly faster than the control group (1463ms, 95% CI [1410ms, 1523ms]; $p = 0.048$). Furthermore, fitness (assessed by distance run on the multi-stage fitness test) was also greater in the intervention group (880m, 95% CI [820m, 940m]) compared to the control group (740m, 95% CI [680m, 800m]; $p = 0.002$). However, adiposity was unaffected (all $p > 0.05$). **CONCLUSIONS:** This series of studies suggest that The Daily Mile is potentially an effective school-based physical activity intervention to enhance cognition and well-being in primary school children. Children's perceptions of The Daily Mile will also be discussed to inform future intervention design.

Comparing Apples and Oranges? Preschoolers' Daily Sedentary Behaviour and Physical Activity Time Estimated From Original and "Equivalent" Cut-Points Adapted to Shorter and Longer Epochs

Costa, S.* & Vale, S.

*School of Sport, Exercise and Health Sciences, Loughborough University, UK. s.costa@lboro.ac.uk

INTRODUCTION: Recognising preschoolers' sporadic physical activity (PA) patterns, studies have adapted validated cut-points to apply in shorter epochs (dividing by 3 a cut-point calibrated in 15-sec epochs, to apply to 5-sec epochs), trying to better capture short bursts of sedentary behaviour (SB) or moderate-to-vigorous PA (MVPA). We studied whether/how daily SB/PA time estimates from adapted cut-points applied to shorter/longer epochs differ from estimates using the original cut-points/epochs. **METHODS:** Data from 3-5-year-olds ($n = 341$; 51% girls) was processed into 5-, 15- and 60-sec epochs. Non-wear time (≥ 20 mins consecutive zeros) was removed, and only days with ≥ 600 mins wear time were used in the analysis ($n = 1705$ days). We used 4 cut-points calibrated and often used with preschoolers: Pate (2006), Evenson (2008), van Cauwenberghe (vanC;2011) and Butte (2014). Original cut-points were divided/multiplied to generate adapted ones for shorter/longer epochs (respectively). Original and adapted cut-points were used to estimate SB, light and MVPA time for each valid day. Difference between estimates was calculated, and we used Lin's concordance coefficient and Bland-Altman plots to check agreement between daily time estimates from using the adapted versus original cut-points/epoch lengths. **RESULTS:** With cut-points adapted to shorter epochs, SB and MVPA time was generally overestimated (mean, SB: 3 to 131; MVPA: 1 to 38 mins), but underestimation also existed (< -27 mins); light PA was generally underestimated (-156 to -13), but overestimation also existed with vanC cut-points ($< +5$ mins). Opposite trends generally occurred when using cut-points adapted to longer epochs. Days meeting PA guidelines also differed from adapted and original cut-point estimates. **CONCLUSION:** Guideline compliance and PA/SB estimates from using original and adapted cut-points should not be compared, as they are not equivalent and reliability/sensitivity/specificity of adapted cut-points is unknown.

Acute Biventricular Function Responses to High Versus Moderate Intensity Interval Exercise in Healthy Children

Dorobantu, D.M.*, Wadey, C.A., Amir N.H., Berryman B., Forsythe L., Stuart A.G., Pieles G.E. & Williams C.A.

*Children's Health and Exercise Research Center, University of Exeter, UK; Congenital Heart Disease Unit, Bristol Royal Hospital for Children, UK. dd389@exeter.ac.uk

INTRODUCTION: Despite clear benefits to health, there is a lack of consensus on the optimal choice in protocols for cardiac rehabilitation, especially in choosing work intensity in those less able to exercise. The aim of the study was to investigate the cardiac function responses to high intensity interval exercise (HIIE) compared to moderate intensity interval exercise (MIIE) in healthy children using state of the art echocardiography. **METHODS:** Fifteen physically active adolescents (9 boys and 6 girls, mean age 13.5±1.6 y) performed two counterbalanced exercise trials on a semi-supine cycle ergometer: A) HIIE: 4 x 4 min work intervals at 40% Δ between peak and gas exchange threshold (GET) B) MIIE: 4 x 6 min work intervals at 90% GET, interspersed by 4 min active recovery intervals at 15 W. Respiratory parameters, heart rate (HR) were measured continuously. Left (LV) and right ventricle (RV) longitudinal strain (SI), novel measures of cardiac function (measured in % deformation), were calculated pre-, during each work and active recovery interval and post-exercise trial. **RESULTS:** Mean (SD) HIIE and MIIE exercise work rates were 122 ±40 and 66±22 W, respectively. HR, oxygen uptake and oxygen pulse during all intervals were higher for HIIE vs MIIE (p<0.05). Both HIIE and MIIE elicited increases in LV/RV-SI compared to rest during exercise (mean difference: 5.5/6.4% for MIIE and 6.8/8.2% for HIIE) and recovery (mean difference: 2.4/3.1% for MIIE and 3.2/4% for HIIE. Average LV/RV-SI were higher in HIIE vs MIIE in exercise (mean difference: 1.1/1.9%) and recovery (mean difference: 0.8%/1.1%), p<0.05 for all comparisons. **CONCLUSIONS:** This study shows for the first time that both MIIE and HIIE elicit significant biventricular function increases, greater in HIIE compared to MIIE. Cardiac rehabilitation programmes should take advantage of both types of protocols, prioritising HIIE when possible, yet also utilising MIIE when needed, such as in those less able to exercise.

Associations Between Cardiorespiratory Fitness and Two Components of Cardiovascular Risk From the Age of 10–13: The NW-CHILD Study

Du Plessis, W.*, Claasen, L. & Monyeki, A.M.

*School of Human Movement Sciences, PhASRec, North-West University. 20376138@nwu.ac.za

INTRODUCTION: This study aimed to determine longitudinal associations between cardiorespiratory fitness and two cardiovascular risk components (obesity and hypertension). Included were South African participants from the NW-CHILD study in 2013 (N=864, mean age=9.88 years, boys=455 and girls=409) and 2016 (N=558, mean age=12.89 years, boys=290 and girls=268). **METHODS:** We collected data using measurements of body mass index, body fat percentage and blood pressure results, as well as cardiorespiratory fitness values from FitnessGram 20m Progressive Aerobic Cardiovascular Endurance Run. We utilised descriptive statistics, analysis of covariance, paired sample t-test, Spearman's rank order correlation and practical effect size to determine associations between cardiorespiratory fitness and two clustered cardiovascular disease risk factors. **RESULTS:** High tracking coefficients were found for body mass index, body fat percentage, and the total

sample's $\dot{V}O_2$ max. Moderate tracking correlations were found for systolic blood pressure; diastolic blood pressure for the girls; and $\dot{V}O_2$ max among boys and girls, yet the total sample and diastolic blood pressure for the boys showed weak correlations. The body fat increase had a significant negative influence on cardiorespiratory fitness levels which decreased insignificantly. The insignificant decrease of cardiorespiratory fitness significantly influenced blood pressure; this being a blood pressure increase among adolescents when adjusted for age and sex. **CONCLUSIONS:** It is important to improve or maintain physical health, as today's children become tomorrow's adults.

Examining the Associations Between Self-Control and Physical Fitness, Health and Wellbeing in Young People

Dunn, A.*, Cooper, S.B., Williams, R.A., Dring, K.J., Walters, G. & Boat, R.

*Department of Sport Science, School of Science and Technology, Nottingham Trent University (United Kingdom). anna.dunn2017@my.ntu.ac.uk

INTRODUCTION: Given the concerning high statistics of low activity levels and the high prevalence of obesity in young people (Sport England 2020), it is important to investigate potential determinants of unhealthy behaviours in this population. One such potential, yet relatively unexplored, determinant of healthy behaviour choices is self-control (Boat et al., 2022). This study aimed to examine the associations between self-control and physical fitness, cardiometabolic health, and wellbeing in an early-adolescent population. **METHODS:** Through a cross-sectional design, 75 children (36 female) aged 9-13 years participated in the study. Participants attended two testing sessions, consisting of anthropometric measurements (sum of skinfolds and waist circumference), multi-stage fitness test (cardiorespiratory fitness), 4 x 10m shuttle run (motor fitness), handgrip strength (musculoskeletal fitness), standing broad jump (musculoskeletal fitness), fasted and post-prandial capillary blood samples (glucose concentrations), a wellbeing questionnaire (Kidscreen-27) and a measurement of trait self-control (Trait Self-Control Scale). **RESULTS:** Pearson's correlation analysis revealed that participants trait self-control was positively correlated with their wellbeing (r = 0.381, p = 0.001), cardiorespiratory fitness (r = 0.360, p = 0.002), and musculoskeletal fitness (r = 0.307, p = 0.007). Furthermore, trait self-control was found to be negatively correlated with participants motor fitness (r = -0.315, p = 0.006). **CONCLUSIONS:** The findings suggest that high self-control is a likely determinant for higher levels of several components of physical fitness. Furthermore, high self-control is associated with positive levels of wellbeing in young people. This creates potential scope for interventions focused on increasing young people's self-control, to in turn lead to healthier lifestyles.

Comparison of the Achilles Tendon Structure Among Obese and Overweight Children and Adolescents as Oppose to Normal Weight Children

Elbaz L.*, Pantanowitz M., Eliakim A., Nemet D. & Steinberg N.

*The Academic College Lewinsky-Wingate Nathania Israel. liav74.elbaz@gmail.com

INTRODUCTION: Obesity among children has increased dramatically in the past decade. However, few researches have discussed the influence of childhood obesity, on the structure and function of the skeletal body. This study compared the Achilles tendon structure, between obese and overweight children to normal weight children. **METHODS:** 76 children

at the ages of 7-15 from the center of Israel were checked. The participants were divided to 3 groups: obese children (above 95% percentage) (22 participants group 1), overweight children (above 85% percentage) (10 participants group 2). Normal weight children (Under 85% percentage) (44 participants group 3). A comparative check of the Achilles tendon structure was done using the UTC – imaging (checking the collagen fiber percentages echo type I, II, III, IV) between the 3 groups. **RESULTS:** A significantly higher percentile of echo-type II, a lower percentile of echo-types III and IV, and a lower cross-sectional area were found for children with normal weight compared to children with overweight/obesity ($p < .05$). Following a piecewise linear regression model according to the tendon structure, a BMI percentile of 75% was found to be the most accurate cutoff point of the children with the “unaffected” ($BMI\% < 75\%$) and “affected” tendon structure groups ($BMI\% \geq 75\%$), as the children with $BMI\% \geq 75\%$ already had an Achilles tendon structure similar to that of the children with overweight/obesity. **CONCLUSION:** Tendon integrity as examined with UTC differs between children with obesity and overweight compared to children with normal weight. Children with a BMI percentile of $\geq 75\%$ already demonstrate a different tendon structure pattern compared to children with BMI percentile of $< 75\%$. This may put children with obesity at a greater risk of injury and should be addressed when applying an exercise program for children with overweight/obesity.

The Effect of Methylphenidate on the Dopamine and Growth Hormone Response to Exercise

Nemet D., Ben Zaken S. & Eliakim A.*

*Child Health and Sports Center, Pediatric Department, Meir Medical Center, Sackler School of Medicine, Tel-Aviv University, Israel. eliakim.alon@clalit.org.il

INTRODUCTION: To assess the growth hormone (GH) and Dopamine (DA) response to exercise in children with attention-deficit hyperactivity disorder (ADHD) with and without methylphenidate (MP). We hypothesized that the GH response to the WANt would be similar to the GH response to a commonly used pharmacologic. **METHODS:** Twenty children participated in the study (12 males and 8 females, age range 9–13 years). Ten with ADHD and 10 controls. Participants with ADHD performed an exercise test twice, with and without MP while controls performed one exercise test. Blood samples for GH and DA were collected before, at peak, 30 and 60 min after the end of exercise. **RESULTS:** Children with ADHD had a significantly lower GH ($P < 0.002$) and DA ($P < 0.01$) responses to exercise with and without MP compared to controls. In participants with ADHD, a significantly greater GH response ($p < .04$) to exercise was found when methylphenidate was administered to the children before exercise, yet this response was lower than controls. **CONCLUSIONS:** GH and DA excretion after an exercise challenge in children with ADHD is impaired. MP slightly attenuates the GH blunted response. This may link ADHD with growth impairment in some children and explain previous findings indicating that the final adult height is usually not compromised in treated children with ADHD. The combined exercise and stimulant treatment therapeutic effects needs to be further explored.

Quadriceps Twitch Contraction Characteristics: Sex and Age Effects

McKiel, A., Woods, S., Faragher, M., Taylor, G. & Falk, B.*

*Department of Kinesiology, Brock University, St. Catharines, ON, Canada. bfalk@brocku.ca

INTRODUCTION: Electrically evoked twitch characteristics quantify contractile properties, independent of motivation or skill. Previous studies, focusing mainly on plantar flexors, reported no age effect. While plantar

flexors are dominated by type-I fibres, quadriceps are characteristically a mixed-distribution. We aimed to examine and compare twitch characteristics of the quadriceps between children and adults, males and females. **METHODS:** Participants included 11 girls, 13 women, 23 boys, and 20 men. Supramaximal square-wave pulses of 10ms were used to elicit resting twitches. Key outcomes included maximal volitional torque (MVC), and peak evoked twitch torque (Tpk), peak rates of torque development (RTD) and relaxation (RTR). To account for group differences in muscle size, muscle depth was assessed with B-mode ultrasound. **RESULTS:** Muscle-size corrected MVC was lower in females compared with males and in children compared with adults (ANCOVA, age and sex effects: $p < 0.001$). Muscle-size corrected Tpk was similar in boys and girls and higher in men compared with women (age-by-sex interaction: $p < 0.05$) ($g: 8.4 \pm 3.5$, $b: 10.0 \pm 4.2$, $W: 23.5 \pm 8.1$, $M: 34.4 \pm 10.1$ Nm). No age or sex differences were observed in the ratio of Tpk to MVC. RTD and RTR were higher in adults compared with children and higher in males compared with females (RTD: $g: 172 \pm 95$, $b: 193 \pm 109$, $W: 537 \pm 169$, $M: 671 \pm 145$ Nm/s; age and sex effects < 0.05 , interaction = 0.10). **CONCLUSIONS:** Contrary to previous findings in the plantar flexors, in the quadriceps, twitch torque is lower and kinetics are slower in children compared with adults. Sex differences in twitch characteristics are apparent in adults but less so in children, with no differences between boys and girls but lower torque and slower kinetics in women compared with men. Potential factors such as muscle composition and related intracellular calcium binding and uptake, as well as hormonal profiles may contribute to the observed age- and sex-related differences.

Sports Participation Mediates the Relationship Between Birth Weight and Bone Density in Female Adolescents

Urban, J.B., Torres, W., Nunes, D.S., Pelegrini, A., Kemper, H.C.G. & Fernandes, R.A.*

*Laboratory of Investigation in Exercise - LIVE, Department of Physical Education, Sao Paulo State University - UNESP, Presidente Prudente, Brazil. romulo.a.fernandes@unesp.br

INTRODUCTION: Low birth weight (BW) and sports participation are two variables affecting adolescent bone health at the same time but in different directions. However little is known about the coexistence of both. In terms of prevention of osteoporosis, it is relevant to know if sports participation is capable to mitigate the potential harmful impact caused by low BW on bone parameters, especially among girls. Thus, the aim of this study to analyze the relationship between BW and bone mineral density (BMD) among female adolescents, as well as to identify if sport participation is able to mediate this relationship. **METHODS:** A total of 141 female adolescents with age ranging from 11 to 18 years-old composed the sample of this study. Areal BMD (g/cm^2) has been assessed using dual energy X-ray absorptiometry, while adolescents' parents reported BW (g). Sports participation was divided into three groups considering the amount of mechanical load on it (control group [score= 0], swimming [score= 1] and impact sports [score= 2]: baseball, basketball, gymnastic, judo, karate, kung-fu, tennis and track and field). Sex, lean soft tissue and somatic maturation adjusted the structural equation models (Dependent variable: BMD, Independent variable: BW and Mediator: sports participation). **RESULTS:** BW was not related to both sports participation ($r = -0.04$ [95%CI: -0.22 to 0.13]) and BMD of lower limbs ($r = 0.10$ [95%CI: -0.03 to 0.23]). However, sports participation was related to BMD ($r = 0.17$ [95%CI: 0.03 to 0.30]), mediating 25.7% of the effect of BW on BMD. **CONCLUSIONS:** Bone density tends to be lower in adolescents with lower BW, while this phenomenon seems significantly mediated by sports participation.

The Eyes Don't Have It: Coach's Eye Is Not a Valid Method of Estimating Biological Maturation

Fitzgerald, F.*, Campbell, M., Kearney, P.E. & Cumming, S.

**Munster Technological University Kerry, Department of Health and Leisure; University of Limerick, Department of Physical Education and Sport Sciences; Kerry GAA, Performance and Research Department.* fionn.fitzgerald@mtu.ie

INTRODUCTION: In Gaelic football, coaches tend to select players on subjective assessments, which are often biased toward players advanced in biological maturation (Fitzgerald et al., 2023). A typical assumption found in talent identification literature is that different coaches, given the same athletes and circumstances, will identify the same subset of athletes as "talented". This study investigated the accuracy of the coaches' eye as a method to estimate players as early, on-time and late maturing and to explore the inter-coach agreement on the assessment of talent in a group of athletes. **METHODS:** Biological maturity was estimated based upon the Khamis-Roche method of percentage of predicted adult height (%PAH) for 247 male adolescent Gaelic footballers (U14-U16; $\text{mage} \pm \text{SD} = 15.1 \pm 0.8$ years). Two coaches were recruited from each of the nine squads (N=18) to provide an estimation of their own players' biological maturation by coaches' eye, rating of each player's current ability, long-term potential and selection of their top 5 and bottom 5 players. Inter-rater reliability was calculated using weighted kappa (K). **RESULTS:** Agreement between coaches' estimation of biological maturity and %PAH ($k=0.17$) was quite poor, supporting the contention that eyeballing players' maturation status may be inaccurate. Coaches' agreement on estimation of maturity ($k=0.33$), and rating of current ability ($k=0.39$) was fair, whereas agreement on future potential (0.41) and top and bottom players ($k=0.55$) was moderate. **CONCLUSIONS:** These findings suggest that coaches' eye may be an inaccurate method of estimating maturation. In addition, this current research suggests, in isolation, there is poor inter-coach agreement in the identification of talented athletes and indicates that the "coach's eye" is subjective and variable.

Making the Motor Competence Assessment Simple: Meu Educativo a New Digital Solution for Professionals Who Work With School-Age Children

Garbeloto, F.*, Pereira, S. & Maia, J.

**CIFI2D, Faculty of Sport, University of Porto, Porto, Portugal.* fegarbeloto@gmail.com

INTRODUCTION: Evidence shows that school-age children with high motor competence (MC) levels tend to be more physically active and perform better academically. Recent data showed its decline in children. The early identification of children with poor MC is well-acknowledged. Hence, it is mandatory that tools to assess MC be available that meet professional (physical education teachers, motor development specialists, sports coaches) needs. Here we present the Meu Educativo, a mobile app to help professionals assess MC and promote children's active and healthy lifestyles. **METHODS:** The Meu Educativo was designed within a domain-reference validity framework to assess children's MC using whole-body and individual component approaches. To this end, a series of phases were conducted with a team of specialists to help develop an MC checklist of 12 fundamental movement skills. Further, two reliability studies were conducted to verify how easy and comprehensive the checklist was. **RESULTS:** The Meu Educativo complete system has a web panel and two mobile apps, one for professionals and the other for

parents/guardians. It offers the possibility to assess fundamental movement skills, sports motor skills (with two new tests exclusively developed for the App), children's engagement levels, anthropometric data, and physical fitness monitoring. Furthermore, both apps have a digital library with up-to-date information on children's health promotion, games to play, and places for sports participation. After children's data collection, the results are available in the system. The app also stores these results allowing for future follow-ups. Legal guardians can also access all results in real time. **CONCLUSIONS:** A variety of professionals have assessed more than 5,000 school-age children reliably, and Meu Educativo meets professional needs efficiently. As such, it can be considered a new tool to efficiently assess MC and encourage a physically active lifestyle in school-age children.

Effects of a Primary School Physical Education Lesson on Cognitive Function in Children

Gilbert, L.M.*, Dring, K.J., Williams, R.A., Boat, R., Sunderland, C., Morris, J.G., Nevill, M.E. & Cooper, S.B.

**Sport, Health, and Performance Enhancement (SHAPE) Research Centre, Department of Sport Science, School of Science and Technology, Nottingham Trent University, Nottingham, United Kingdom.* luke.gilbert@ntu.ac.uk

INTRODUCTION: Despite the positive impact of moderate-to-vigorous physical activity (MVPA) on cognitive function in children, the potential for primary physical education (PE) to influence cognition during the school day has not been examined. **METHODS:** Following familiarisation, 23 (9 female) children (10.4 ± 0.5 y) completed two trials (45-min invasion game PE lesson and 45-min academic lesson) separated by 7-d. Heart rate monitors were worn to determine average and maximum heart rate and MPVA time (time spent $>64\%$ max heart rate). Attention and executive function (Stroop task), working memory (Sternberg paradigm), and perception (visual search test) were assessed 30-min before, immediately post-, and 45-min post-lesson via computerised cognitive tests. **RESULTS:** During the PE lesson, the average heart rate was 150 ± 14 beats.min⁻¹, maximum heart rate was 200 ± 8 beats.min⁻¹ and MVPA time was $71 \pm 13\%$ (32 ± 6 min). Overall, a 45-min invasion game PE lesson enhanced perception (trial* time interaction, $p < 0.001$, partial eta squared = 0.311) with improved response times on the complex level of the visual search test immediately (1630 ± 461 ms vs. 1882 ± 568 ms; $t(22) = 2.121$, $p = 0.045$, $d = 0.44$) and 45-min (1407 ± 405 ms vs. 1780 ± 621 ms; $t(22) = 3.932$, $p < 0.001$, $d = 0.82$) post-PE lesson when compared to the academic lesson. The pattern of change for working memory on the five-item level of the Sternberg paradigm also differed between trials (time * trial interaction, $p = 0.049$, partial eta squared = 0.128). However, post-hoc analyses were not statistically significant (all $p > 0.05$). Attention and executive function were unchanged following the PE lesson (trial*time interaction, all $p > 0.05$). **CONCLUSIONS:** This study provides novel evidence of the acute cognitive response to an invasion game PE lesson; emphasising that school-based physical activity, specifically primary PE, can positively influence cognitive function in children.

Physical Activity Levels in Children and Young People in Wales During and Following the COVID-19 Pandemic

Goodliffe, F.*, Mackintosh, K.A., Hurter, L., Roddis, B., Sharp, C.A., Stratton, G., McNarry, M.A.

**Applied Sports, Technology, Exercise and Medicine (A-STEM) Research Centre, Swansea University, UK.* 1907676@swansea.ac.uk

INTRODUCTION: During the COVID-19 pandemic, the Welsh Government mandated engagement of only local outdoor physical activity (PA). This study aimed to determine the impact of this on children's PA levels in connection with wellbeing. **METHODS:** 800 children aged 8-18 years completed a validated questionnaire to evaluate wellbeing and wore an accelerometer on their non-dominant wrist for 7 consecutive days at 4 time-points associated with increasingly relaxed restrictions (Jan, Apr-May and Sep 2021, and Feb 2022). Time spent sedentary and in light (LPA) and moderate-to-vigorous PA (MVPA) were determined using GGIR. Linear-mixed models were used to assess differences between each movement behaviour and wellbeing parameters across time-points. **RESULTS:** All PA metrics significantly increased after Jan 2021 (MVPA: $\beta=20.8$, 95% confidence interval (CI):14.2-27.5, $p<0.001$; LPA: $\beta=41.8$, CI:26.1-57.5, $p<0.001$) except sedentary time ($\beta=-73.78$, 95% CI:-113.48—-34.08, $p>0.05$). There were no sex differences in MVPA during lockdown, but boy's MVPA increased at all other time-points (2nd time-point: $X^2=24.33$, $p<0.001$; 3rd: $X^2=23.25$, $p<0.001$; 4th: $X^2=7.66$, $p<0.001$). There was a significant relationship between wellbeing and MVPA across all time-points ($\beta=0.028$; 95% CI:0.01-0.49; $p<0.05$), with significant improvements in wellbeing between the 2nd and 3rd (2.1 ± 0.7 ; $p=0.005$) and 4th (4.89 ± 1.80 ; $p=0.007$) time-points. **CONCLUSIONS:** The results suggest a major negative impact of lockdown on children's movement behaviours. The lack of sex differences during lockdown suggests that boys may have been more adversely affected, possibly due to the halting of the male-dominated formal sport clubs. Whilst PA increased markedly after restrictions were lifted, girls PA remained below recommended guidelines. Wellbeing improved as restrictions were lifted implying the pandemic was detrimental to wellbeing, potentially due to restricted PA. Interventions targeting girls especially are urgently warranted.

Global Trends: A Systematic Review of the Relationship Between Air Pollution, Physical Activity and Lung Function in Youth Aged 5–16 Years With and Without Asthma

Gudziunaite, S.*, Griffiths, C.J., Jordan, K.A., Davies, G.A., Mackintosh, K.A., Lewis, P.D. & McNarry, M.A.

**Applied Sports, Technology, Exercise and Medicine (A-STEM) Research Centre, Swansea University, Swansea, UK. 2140914@swansea.ac.uk*

INTRODUCTION: Children are more susceptible to air pollution due, at least in part, to their less-developed respiratory systems and higher respiratory rates. The health benefits associated with physical activity are indisputable, there is considerable debate regarding whether increased exposure to, and deeper inhalation of, air pollution while being physically active negates such health benefits. Objectives: This review explored the relationship between air pollution and lung function and the influence of asthma status and physical activity on this relationship in children and adolescents. **METHODS:** Six databases were searched following PRISMA guidelines with no date restrictions: PubMed, Web of Science, MEDLINE, EMBASE, SPORTDiscus, and Cochrane Central Register of Controlled Trials (CENTRAL). Studies were included if they: i) studied children (5 – 16 years); ii) were peer-reviewed; iii) were available in the English language; and iv) reported data using predetermined validated tools. **RESULTS:** A total of 11,262 references were retrieved, of which 3,857 were duplicates, and 7,392 were excluded as they did not meet the inclusion criteria, resulting in 13 included studies. Increased exposure to various air pollutants, particularly during outdoor physical activity, resulted in lung function deficits, with slight variation according to the type of pollutant. This was especially concerning in children with pre-established respiratory conditions, such as asthma. **CONCLUSIONS:** Children

with respiratory conditions, including asthma, were more sensitive to pollution and, therefore, may benefit from individualised physical activity interventions and frequent asthma management re-evaluations. Given the potent and potentially long-term effects of air pollution, governments and local authorities must continue to reduce air pollution levels to improve the current and future health of children globally.

Predictors of Team Selection in Young Basketball Players: The Inex Study

Guimarães, E.*, Baxter-Jones, A.D.G., Williams, A.M., Tavares, F., Janeira, M.A.J. & Maia, J.

**CIF12D, Faculty of Sport, University of Porto, Portugal. eguimaraes@fade.up.pt*

INTRODUCTION: Young athletes of the same chronological age differ in their physical growth, biological maturation, motor performance, and training history. These differences make it difficult for coaches to select athletes. In this study, we investigate whether training experience, biological maturation, physical performance, and technical skills are linked with team selection in a group of youth basketball players. **METHODS:** In total, 211 male basketball players from four age cohorts (12-15 years) were followed biannually over three consecutive years. During each year, "elite" players were selected by the coaching staff of the Porto Basketball Association to set the under-16 regional team (0=non-selected; 1=selected). Training experience, biological maturation, five physical performance tests, and four technical skill tests were assessed. Overall measures of physical performance and technical skill were used after transforming individual outcomes into z-scores and summing them. A longitudinal multilevel logistic regression model was used, and the analysis was done in the SuperMix 2.0 software. The data were gathered as part of the INEX study. **RESULTS:** Training experience (OR=1.42; 95%CI 1.01–2.00), biological maturation (OR=10.21; 95%CI 3.70–28.13), and overall technical skill (OR=1.55; 95%CI 1.14–2.10) were significant predictors of team-selection, whereas the overall physical performance (OR=0.84; 95%CI 0.64–1.10) did not significantly predict the chances of being selected. **CONCLUSIONS:** For basketball players to be part of the "elite" under-16 team, what apparently counts most in the eyes of coaches is their biological maturation followed by training experience and technical skills. After accounting for these factors, physical performance is not a discriminating marker. These findings reveal that selectors tend to favor players who might guarantee immediate competitive success.

Which Indices of Cardiorespiratory Fitness Are More Strongly Associated With Brain Health in Children With Overweight/Obesity?

Haapala, E.A.*, Lubans, D. R., Jaakkola, J., Barker, A.R., Plaza-Florio, A., Gracia-Marco, L., Solis-Urra, P., Cadena-Sanchez, C., Esteban-Cornejo, I. & Ortega, F.B.

**Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland; Institute of Biomedicine, School of Medicine, University of Eastern Finland, Kuopio, Finland. eero.a.haapala@jyu.fi*

INTRODUCTION: To compare the strength of associations between different indices of cardiorespiratory fitness and brain health outcomes in children with overweight/obesity. **METHODS:** Participants were 100 children aged 8–11 years. CRF was assessed using an incremental treadmill exercise test (peak oxygen uptake [$\dot{V}O_{2peak}$], treadmill time, and $\dot{V}O_2$ at ventilatory threshold) and 20-metre shuttle run test (20mSRT, laps, running speed, estimated $\dot{V}O_{2peak}$ using the equations by Léger

et al., Mahar et al., and Matsuzaka et al.). Intelligence, executive functions, and academic performance were assessed using validated methods. Total grey matter and hippocampal volumes were assessed using structural magnetic resonance imaging. **RESULTS:** $\dot{V}O_2$ peak/body mass (standardised regression coefficient $\beta=0.18$, 95% CI=0.01 to 0.35) and treadmill time ($\beta=0.18$ to 0.21, 95% CI=0.01 to 0.39) were positively associated with grey matter volume. 20mSRT laps were positively associated with executive functions ($\beta=0.255$, 95% CI=0.089 to 0.421) and academic performance ($\beta=0.199$ to 0.255, 95% CI=0.006 to 0.421), and the running speed was positively associated with executive functions ($\beta=0.203$, 95% CI=0.039 to 0.367). Estimated $\dot{V}O_2$ peak/Léger et al. was positively associated with intelligence, executive functions, academic performance, and grey matter volume ($\beta=0.205$ to 0.282, 95% CI=0.013 to 0.500). Estimated $\dot{V}O_2$ peak/Mahar et al. and $\dot{V}O_2$ peak/Matsuzaka et al. (speed) were positively associated with executive functions ($\beta=0.204$ to 0.256, 95% CI=0.031 to 0.436). **CONCLUSIONS:** Although $\dot{V}O_2$ peak is considered the gold-standard indicator of CRF, peak performance (laps or running speed) and estimated $\dot{V}O_2$ peak/Léger et al. derived from 20mSRT had stronger and more consistent associations with brain health outcomes than other indices of CRF in children with overweight/obesity. Moreover, maximal indices of CRF were more strongly related to brain health outcomes than submaximal indices.

The Influence of Motor Competence on Broader Aspects of Health: A Systematic Review of the Longitudinal Associations Between Motor Competence and Cognitive and Social-Emotional Outcomes

Hill, P. J.*, McNarry, M. A., Mackintosh, K. A., Murray, M., Pesce, C., Valentini, N. C., Getchell, N., Tomporowski, P. D., Robinson, L. E. & Barnett, L. M.

**Applied Sport Technology Exercise and Medicine Research Centre, Swansea University, Swansea, Wales, United Kingdom.* Phillip.Hill@wales.nhs.uk

INTRODUCTION: Motor competence has important developmental associations with aspects of physical health, but there has been no synthesis of longitudinal associations with cognitive and social-emotional health. This systematic review sought to i) present a conceptual model that positions motor competence as a mediator between physical activity and cognitive and social-emotional outcomes; and ii) synthesise the association of motor competence and cognitive and social-emotional development using longitudinal observational and experimental evidence. **METHODS:** Five electronic databases (PubMed, Web of Science, Scopus, PsycINFO and SPORTDiscus) were systematically searched. Following study screening and risk of bias assessment by two authors, 49 eligible studies were identified for inclusion. Evidence for domain-specific paths was synthesised by calculating the significant analyses in the hypothesised direction, divided by the total number of analyses for that path. These percentages were then collated for each domain outcome. **RESULTS:** Longitudinal observational evidence about domain-specific and global associations of motor competence and cognitive and social-emotional health is indeterminate. The included studies provided no evidence for a consistent moderating role of age or sex. Some preliminary experimental evidence does support the role of motor competence in moderating the influence of cognitively enriched physical activity on cognitive outcomes, especially working memory and social-emotional skills. However, insufficient studies were appropriately designed to identify the moderating role of contextual mechanisms. **CONCLUSIONS:** Between-study heterogeneity precludes the identification of definitive domain- and construct- specific relationships between motor competence and social-emotional outcomes. To further

develop our understanding, it is important that researchers acknowledge the complexity of these relationships within rigorous study designs.

Using Compositional Analysis to Explore Physical Activity Patterns in Youth With Asthma

Jordan, K.A.*, Mackintosh, K.A., Davies, G.A., Griffiths, C.J., Chastin, S. & Runacres, A., McNarry, M.A.

**Applied Sports, Technology, Exercise and Medicine (A-STEM) Research Centre, Swansea University, UK.* m.mcNarry@swansea.ac.uk

INTRODUCTION: The Global Initiative for Asthma (GINA) encourages children diagnosed with asthma to follow the Government guidelines of achieving an average of 60minutes of moderate-to-vigorous physical activity (MVPA) a day. However, less than 5% of children achieve this. Despite physical activity (PA) being a crucial management tool for asthma, PA interventions have failed to achieve meaningful, or sustained, improvements. This may be due to a lack of consideration for PA composition, whereby, due to the finite nature of a day, increases in one domain must be at the expense of another. This study sought to investigate how PA is accumulated in children with and without asthma, and the interrelated effects of displacing movement behaviours. **METHODS:** Data from 7,114 children (7-15 years) was amalgamated and harmonised prior to a compositional data analysis approach being utilised. The relationship between lung function and movement behaviours was examined using multiple linear regression and the temporal reallocation of 5 - 15 minutes between movement behaviours on lung function investigated, according to asthma status, age and sex. **RESULTS:** Whilst the overall volume of PA did not differ by disease status, the pattern of accrual significantly differed. Children with asthma spent less time sedentary (774 mins per day and 905 mins per day, respectively), and more time in light PA (552 mins per day; 433 mins per day, respectively). VPA was found to be the strongest determinant of lung function, with the displacement of any amount of time away from this behaviour detrimental. **CONCLUSIONS:** These findings highlight the importance of protecting MVPA for lung function, irrespective of age or sex. This provides important insights for future interventions seeking to improve the movement behaviours and lung function of those with asthma. Indeed, understanding the optimal composition of PA could greatly improve conversations around disease management between clinicians and patients.

Preschooler Physical Activity Classification Using Ankle Accelerometry and Machine Learning

Letts, E.G.*, Trost, S.G. & Ahmadi, M.N.

**Child Health and Exercise Medicine Program, Faculty of Health Sciences, McMaster University, Canada.* lettse@mcmaster.ca

INTRODUCTION: Ankle mounted accelerometers are easy for young children to wear for extended periods, improving wear compliance. However, validated methods for processing raw ankle accelerometer data in preschool children are lacking. The aim of this study was to develop machine learning (ML) classification models to detect physical activity type in free-living preschoolers from ankle-worn accelerometer data. **METHODS:** 31 children (4.0±0.9 y) were video recorded during a 20-minute free play session while wearing an ActiGraph GT3X+ (100 Hz) on their ankle. Video recordings were continuously coded into 5 classes: sedentary (SED), light-intensity activities and games (L_ACT_G), moderate-vigorous activities and games (MV_ACT_G), walking (WALK), and running (RUN). 25 time and frequency domain features were extracted from non-overlapping windows of 3s, 5s, 10s, and 15s. Four supervised learning algorithms [K-nearest neighbor, decision

tree, random forest (RF), gradient boosted trees (GB)] were used to build classifiers in python scikit-learn (v1.2.2). Models were evaluated using leave-one-subject-out-cross-validation with F-scores, overall accuracy, and confusion matrices. **RESULTS:** Over all window sizes, RF and GB provided greater accuracy. For all algorithms, accuracy improved with increasing window size. RF using 15s windows performed best with an F1 score of 0.60 and overall accuracy of 75%. Recognition accuracy (%) for each class was: SED: 65, L_ACT_G: 85, MV_ACT_G: 31, WALK: 59, RUN: 82. SED, WALK, and MV_ACT_G windows were consistently misclassified as L_ACT_G. **CONCLUSIONS:** Preschooler ML activity classification models for ankle-worn accelerometer data provide acceptable real-world activity recognition. However, recognition was poor for some activity classes and overall accuracy was lower than classifiers trained on hip and wrist data.

Are Maximal Exercise Variables the Most Suitable Approach for Evaluating the Fitness and Health of Children With Obesity?

Mainzer, G.*, Peled, K., Zucker-Toledano, M., Bar-Yoseph, R. & Kodesh, E.

*Pediatric Heart Institute, Edmond and Lily Safra Children's Hospital, Sheba Medical Center, Tel Hashomer, Israel; Pediatric Cardiology unit, Padeh Medical Center, Poriya, Israel. gurmainzer@gmail.com

INTRODUCTION: While maximal exercise testing is widely accepted as the gold standard for evaluating maximal aerobic capacity and overall health, it may present limitations in children with obesity due to their submaximal performance. Submaximal variables such as the VO₂ in the Anaerobic Threshold (AT), Oxygen Uptake Efficiency Slope (OUES) and the VE/VCO₂ slope, intercept and nadir, may have the potential to overcome the constraints associated with maximal exercise testing. **METHODS:** One hundred fifty-three (50.9% Females), children and adolescents (aged 6-18), with (n=87) and without obesity (n=66) completed a maximal cardiopulmonary exercise test on treadmill at the pediatric cardiology unit in Baruch Padeh Hospital. Maximal effort defined by RER > 1.1 and HR_{max} > 85% of predicted. Maximal and submaximal cardiopulmonary parameters were collected throughout the test. **RESULTS:** In the Obese group, maximal effort was attained by 57% of participants, with only 26.4% reaching above 80% of the predicted values for VO_{2max}. This is in contrast to the non-obese population, where 89% of individuals achieved maximal effort (P < 0.0001), and 78.7% achieved above 80% of the predicted VO_{2max} values.). In addition, submaximal parameters such as the AT and the OUES/kg were lower in those with obesity (AT: 21.24 ± 4.64 vs. 26.4 ± 5.32, p = 0.0001; OUES: 30.5 ± 6.2 vs. 39.0 ± 9.5, P = 0.0018). No differences were found in the respiratory equivalents to VCO₂ (VE/VCO₂ slope, VE/VCO₂ intercept and VE/VCO₂ nadir) between the obese and the non-obese groups. **CONCLUSIONS:** Maximal exercise data obtained from obese children may have limited value due to lower levels of effort and submaximal performance. Submaximal parameters, however, such as AT and OUES (but not VE/VCO₂) may provide insights into the physiological responses during exercise, and may serve as a useful indicator in assessing the fitness and functional capacity of obese children.

Can a Manual Wheelchair Skills Training Program Improve Mobility in Children With Disabilities? Protocol for a Multi-Centre Randomized Waitlist Controlled Trial

Moore, S.A.*, Rushton P.W., Sheriko, J., Kirby, R.L., Arbour-Nicitopoulos, K.P., Tib, T., Ouellet, B., Routhier, F., Lamontagne, M.E. & Best, K.L.

*School of Health and Human Performance, Dalhousie University, Halifax, Canada; Health Populations Institute, Dalhousie University, Halifax, Canada; Department of Pediatrics, Dalhousie University, Halifax, Canada. sarah.moore@dal.ca

INTRODUCTION: Children who experience physical disability may use a manual wheelchair (MWC) to support their self-directed mobility. Yet very few children receive training on how to use their MWC effectively. We have received funding to conduct a multi-centre randomized controlled trial. The primary objective is to test the hypothesis that children who receive MWC skills training will have higher skills capacity compared with children who receive usual care. The secondary objective is to explore the influence of MWC skills training on self-efficacy and satisfaction with participation in meaningful activities. **METHODS:** We will conduct a multi-centre, parallel-group, single-blind randomized controlled trial. A sample of 60 children who use MWCs will be recruited in rehabilitation centres, specialized schools, and the communities of three Canadian cities (Halifax, Montréal, Quebec City). Participants will be randomised (1:1) to the experimental (MWC training program) or waitlist control group (usual care). Measures will be completed at baseline, and 3- and 6-months (post-intervention). The primary outcome will be MWC skills capacity at post-intervention. Secondary outcomes will be MWC activity, MWC use self-efficacy, satisfaction with participation (child and caregiver), and caregiver perceived MWC skills. The MWC skills training will consist of 12 sessions, 30-45 minutes each, delivered 1-2 times per week. Training will be customized according to the child's baseline skills and participation goals. The waitlist control group will receive usual care for 3 months and then receive the intervention. **CONCLUSIONS:** The results of this multi-centre randomized controlled trial will illustrate whether a MWC skills training program is effective for children experiencing disability. If proven effective in improving MWC skills amongst children, future work may assess program implementation in pediatric rehabilitation settings, and within school and community programs.

Physical Activity and Cardiorespiratory Fitness in Pediatric Inflammatory Bowel Disease

Morin, S.A.*, da Silva, S.M., Byra, M.M., Issenman, R.M., Timmons, B.W. & Obeid, J.

*Child Health & Exercise Medicine Program, Department of Pediatrics, McMaster University, Hamilton, Canada. morins1@mcmaster.ca

INTRODUCTION: Patients with inflammatory bowel disease (IBD) may have reduced physical activity (PA) and cardiorespiratory fitness (CRF). This can have implications for overall health and wellbeing, as a diagnosis of IBD, low PA, and low CRF are independently associated with reduced quality of life and increased risk of secondary complications, including cardiometabolic diseases. There is limited research in pediatric IBD examining both PA and CRF. Therefore, this study aims to (1) describe PA and CRF in pediatric IBD, and (2) assess the relationship between PA and CRF in pediatric IBD. **METHODS:** We recruited patients between the ages of 7-17 years with a single confirmed diagnosis of IBD. Height and weight were assessed. Participants completed the McMaster All-Out Continuous Progressive Cycling protocol to assess CRF, defined as peak oxygen uptake (VO_{2peak}). Accelerometers were worn during waking hours for 7 consecutive days to quantify daily average of total PA (TPA), light PA (LPA), and moderate-to-vigorous PA (MVPA). Descriptive statistics and multiple regression analyses were used to determine the relationship between PA variables and VO_{2peak}. **RESULTS:** Thirty-two children and adolescents completed the study (41% females; age: 14.7 ± 1.82 years). PA levels were low (TPA: 161.1 ± 56.2 min/day; LPA: 114.0 ± 39.0 min/day; MVPA: 47.5 ± 24.4 min/day), with only 23% of participants meeting the 24-hour movement guidelines of at least 60 min/day of

MVPA. CRF was also low (VO_{2peak} : 40.4 ± 7.16 mL/kg/min), with only 26% of participants achieving their estimated predicted value or higher. Only TPA ($\beta=0.086$, $SE=0.026$, $p=0.003$) was positively associated with VO_{2peak} ($F(2,23)=12.95$, $R^2=0.53$, $p<0.001$). **CONCLUSIONS:** Our findings confirmed that youth with IBD are not engaging in enough PA and present with low CRF. Given the positive link between PA and CRF, future research should assess the potential for PA interventions to improve CRF and health-related outcomes in youth with IBD.

Reduced Exercise-Induced Growth Hormone Secretion Among Children With Attention-Deficit Hyperactivity Disorder

Nemet, D.*, Ben-Zaken, S., Eliakim, R.A. & Eliakim, A.

*Child Health and Sports Center, Pediatric Department, Meir Medical Center, Sackler School of Medicine, Tel-Aviv University, Israel. [dan.nemet@clalit.org.il](mailto:nemet@clalit.org.il)

INTRODUCTION: Attention-deficit/hyperactivity disorder (ADHD) is typically a chronic, often lifelong condition. Data suggest that ADHD itself and its treatment may be associated with dysregulated growth, including height and BMI. The reason for this association is yet unknown. The objective of this study was to examine differences in growth hormone (GH) response to exercise between children who had received a diagnosis of ADHD and age- and gender-matched controls. We reasoned that the normal increase in circulating GH seen in response to exercise would be blunted in children with ADHD. **METHODS:** We recruited 13 treatment-naïve children with newly diagnosed ADHD and 14 age-matched controls (all male) and measured GH response to an exercise test in which the work was scaled to each subject's physical capability. **RESULTS:** There was no difference in the peak heart rate achieved during exercise between controls and ADHD participants (196.6 ± 1.5 vs. 196.5 ± 2.1 bpm, respectively) and lactate response to exercise (53.8 ± 5.0 vs. 47.9 ± 3.8 mg/dL, respectively). After exercise, GH increased significantly in the control subjects ($p < 0.005$), while GH responses were substantially blunted in the ADHD group ($p = NS$) even though the work performed did not differ from controls. **CONCLUSIONS:** Our data suggest that GH excretion after exercise challenge in children with ADHD is impaired. This can be detected using a minimally invasive, nonpharmacologic challenge and may link ADHD with growth impairment in some children.

Surveillance of Youth Sports in the United States: Strengths, Limitations and Future Directions

Pfeiffer, K.A.* & Clevenger, K.A.

*Department of Kinesiology, Michigan State University, East Lansing, MI, USA. kap@msu.edu

INTRODUCTION: A common avenue through which children and adolescents engage in physical activity is through sport participation. National surveillance of behaviors, including physical activity and sport, can provide insight with respect to population-level trends. The purpose of this investigation was to characterize the existing sources of surveillance for organized youth sport participation in the United States and highlight gaps in knowledge. **METHODS:** We identified nationally representative and free publicly available surveillance data from 2012-2022 and report the prevalence of sport participation, the number of sports in which youth participated, and in which specific sports youth participated overall, and by sex/gender, age, grade, and race/ethnicity. **RESULTS:** Eight surveillance systems met our inclusion criteria. Across systems, estimates ranged from 39.6% to 81.5% of youth participating in any organized sport, with 21.8%

to 30.4% of youth participating in one sport. The most common sports in which youth participated were basketball and soccer. Limited information with respect to characteristics of sport participation was collected across systems. **CONCLUSIONS:** While multiple sources of data regarding overall organized youth sport participation are available, there is little information further characterizing this participation (e.g., setting, volume, specialization, history), limiting ability to examine important aspects that are related to public health. Comprehensive, on-going, national surveillance of multiple youth sport domains is needed in the United States to inform sport-promoting policy and ensure equitable provision of quality sport experiences to all youth.

Pathways of Associations Between Motor Proficiency and Physical Fitness During Earlier and Later Childhood, But Differ Between Boys and Girls

Pienaar, A.E.*

*Physical Activity, Sport and Recreation (PHaSRec), Faculty of Health Science, Potchefstroom Campus, North-West University, South Africa. anita.pienaar@nwu.ac.za

INTRODUCTION: Understanding relationships between motor proficiency and physical fitness is important for the future health of children, although longitudinal findings of this nature is limited. This study investigated the association between motor proficiency (MP) and physical fitness (PF) during earlier childhood (six and nine-years-old) and later childhood (12-years-old) in children. **METHODS:** A stratified and randomized research design including a baseline and two follow up time-point measures (2010, 2013 and 2016) were used. Primary school children ($N=374$, boys=178; girls=196) were tested with the BOT-2, Short Form, and the TGMD- 2, at ages 6 and 9 years, and with the Progressive Aerobic Cardiovascular Endurance Run (PACER) at age 12 years. Spearman Rank Order Correlations and stepwise regression analyses were used to analyze the data. **RESULTS:** Evidence of a longitudinal, dynamic but also stable relationship between MP and PF were found but with different gender specific relationships in these pathways of association. The association with PF at 12 years in girls was influenced by both object control skills (OCS), and Motor Proficiency (MP), although only MP contributed to the variation found in boys. **CONCLUSIONS:** Motor proficiency, including object control skills during earlier and middle childhood should be considered as possible triggers of physical activity which again, can increase physical fitness during later childhood. Obtaining early proficiency in these developmental areas is therefore important to the future health of children.

The Influence of Exercise on Cardiorespiratory Fitness in Children and Adolescents: A Systematic Review

Runacres, A.W.H.*, McNarry, M.A. & Barker, A.R.

*Institute of Sport, Manchester Metropolitan University, Manchester, UK. a.runacres@mmu.ac.uk

INTRODUCTION: Cardiorespiratory fitness (CRF) is integral for health and athletic performance in youth and the respective impacts of growth, sex, maturation, and their interactions on CRF are well-documented. However, whilst training induced CRF adaptations have been extensively studied, and reviewed, the intensity and duration of exercise needed to elicit improvements in CRF throughout adolescence remains controversial. Therefore, the aim of this systematic review was to determine the effect of exercise, and individual (i.e., age, sex) characteristics, on CRF adaptations

during childhood and adolescence. **METHODS:** 4,897 English language articles were retrieved from Web of Science, PubMed and SportDiscus databases. Studies were included if: i) they measured CRF directly or indirectly before and after a training intervention; ii) they included a non-exercise control group, and iii) the participants were between the ages of 8-18 years. Studies including children and adolescents with pre-existing medical conditions were excluded. **RESULTS:** The most common types of exercise implemented to improve CRF were high-intensity interval training (HIIT; 33.3%), endurance training (ET; 24.8%), and resistance training interventions (13.9%). Most studies included both male and female participants (65.3%), with only 13.0% and 21.7% including only girls and boys, respectively. Eighteen percent of training studies included obese participants, 9.7% included overweight youth, with the remaining 73.3% including normal-weight children and adolescents. **CONCLUSIONS:** Nearly three quarters of the paediatric training literature on exercise and CRF is focused on HIIT, ET, and resistance training interventions indicating a lack of evidence on the effect of concurrent training programmes in youth. Additionally, this review provides key insights for practitioners and researchers to optimise the effectiveness of exercise interventions for CRF in youth.

Differences in Cardiorespiratory Fitness According to Age, Sex, and BMI in Portuguese Schoolchildren

Santos, C.*, Katzarzyk, P.T., Garganta, R., Vasconcelos, O., Pereira, S., Garbeloto, F., Guimarães, E., Santos, R., Gomes, P.P., Borges, R., Hedeker, D., Barreira, T., Go T., Chaput, J.P. & Maia, J.

**CIFID2, Faculty of Sport, University of Porto, Portugal; CIDEFES, Lusófona University, Lisbon, Portugal. carlass@fade.up.pt*

INTRODUCTION: Cardiorespiratory fitness (CRF) is an important health marker in children. CRF increases during childhood, with boys outperforming girls. Children with obesity tend to be less fit than their normal-weight peers, and children who engage in moderate-to-vigorous physical activity (MVPA) are more likely to show higher CRF. This cross-sectional study investigated age-, sex-, and BMI differences in primary schoolchildren CRF while controlling for their MVPA. **METHODS:** Data come from the REACT project, and a total sample of 757 Portuguese children (392 girls), aged 6-9 years, were included. Using the World Health Organization cut-off points, children's BMI was divided into two categories: normal-weight and obesity. MVPA was obtained via wrist-worn accelerometry for 7 consecutive days, and CRF was assessed with the PACER test. A two-way ANOVA model was used to test for CRF mean differences in each sex separately. Then, an ANCOVA model with MVPA as a covariate was used. Effect sizes were also calculated (partial eta square, η^2). All analyses were done in SPSS. **RESULTS:** On average, older children (girls: $F=7.07$, $p<0.001$, $\eta^2=0.052$; boys: $F=9.20$, $p<0.001$, $\eta^2=0.072$) and those with obesity (girls: $F=47.82$, $p<0.001$, $\eta^2=0.111$; boys: $F=53.62$, $p<0.001$, $\eta^2=0.131$) had significantly lower CRF compared with younger children and those with normal-weight. An age-by-BMI significant interaction only occurred in boys ($F=3.93$, $p=0.009$, $\eta^2=0.032$). After controlling for MVPA, a similar trend was observed in CRF differences. **CONCLUSIONS:** Girls and boys increased their CRF from 6 years onwards. Obesity was negatively associated with CRF in both boys and girls, even when controlling for MVPA. These results may be helpful for physical education teachers when planning their classes and/or intervention programs to better support children with obesity and lower CRF.

Achilles Tendon Structure and Its Relation to Hip Muscles Strength in Young Dancers

Shenhar, M.*, Sitton, Y., Zafrani, R., Siev-Ner, I. & Steinberg, N.

**The Academic College Levinsky-Wingate (Wingate Campus), Netanya, Israel. michal.shenhar@gmail.com*

INTRODUCTION: Achilles tendon structure changes in response to physical load, where high loads and strains gained from physical activities might be related to Achilles tendon injuries. Reduced hip muscle strength might also be related to Achilles tendon injury. Yet, there is lack of knowledge regarding the relation between hip muscle strength and Achilles tendon structure in young dancers. The aim of the research was to assess the relationship between Achilles tendon structure and hip muscle strength in young dancers. **METHODS:** 55 dancers aged 10-16 participated. The participants were measured for anthropometrics. Lower extremity muscle strength was assessed by handheld dynamometer. Achilles tendon structure was measured using a musculoskeletal ultrasound and ultrasonic tissue characterization (UTC), that calculates four echo-types (echo-type I being the most organized and echo-type IV being the least organized). **RESULTS:** Average age, height, weight, and BMI were 12.8 ± 2.9 years, 154.3 ± 13.9 cm, 46.7 ± 12.8 kg, 19.2 ± 3.1 respectively. The Achilles tendon contained on average 55.7 ± 10.0 , 38.4 ± 8.2 , 4.6 ± 3.59 , 1.0 ± 0.8 percent fibers echo-type I-IV respectively. There were significant correlations between age and tendon width, area, and echo-type III fibers ($r=0.29$, $r=0.38$, $r=-0.30$ respectively, $p<0.05$). Significant correlations were found between echo-type III and IV fibers and knee flexion ($r=-0.30$), knee extension ($r=-0.35$), hip abduction ($r=-0.46$), hip external rotation ($r=-0.36$) and hip flexion strength ($r=-0.42$). Significant correlations were found between tendon thickness and hip flexion ($r=0.31$), and hip external rotation strength ($r=0.35$). **CONCLUSIONS:** In young dancers, Achilles tendon size increased with age. High prevalence of disorganized tendon fibers was found to be related to reduced hip muscle strength; thicker tendon was related to increased strength of those muscles. A constructed intervention program for improving tendon fiber organization and size is advised.

Associations of Physical Activity and Physical Fitness With Cognitive Function, Self-Control, and Resilience in Attention Deficity Hyperactivity Disorder in Young People

Sibbick, E.*, Boat, R., Sarkar, M., Johnston, J.P., Groom, M., Williams, R.A., Sun, F.H. & Cooper, S.B.

**Department of Sport Science, School of Science and Technology, Nottingham Trent University, UK. elise.sibbick2020@my.ntu.ac.uk*

INTRODUCTION: The aim of the present study was to investigate if physical activity and physical fitness were associated with the important psychological constructs of cognition, self-control, and resilience; all of which have great importance in academic performance and day-to-day functioning in young people with attention deficit hyperactivity disorder (ADHD). **METHODS:** Fifty-four children with ADHD (12.8 ± 1.39 y) completed questionnaires to assess self-control, resilience, and physical activity, wore an accelerometer for 7 d to assess free-living physical activity, completed a battery of cognitive tasks and a multi-stage fitness test (measuring cardiorespiratory fitness). **RESULTS:** Statistically significant associations were found between physical fitness and performance on the simple level of the Stroop task ($r(52)=-0.386$, $p=0.004$) and the incongruent ($r(52)=-0.349$, $p=0.010$) and congruent level of the Flanker task ($r(52)=-0.303$, $p=0.026$); whereby those who had greater fitness had better cognitive performance. Vigorous physical activity was shown to be positively correlated with self-control ($r(37)=0.424$, $p=0.007$); additionally, young people who completed more of their active time in high intensity activities (as measured by the intensity gradient) also reported higher self-control ($r(37)=0.370$, $p=0.021$). There was also a tendency for a positive association between physical fitness and resilience ($r(52)=0.253$,

$p=0.065$); yet there were no associations between physical activity and resilience (all $p>0.05$). **CONCLUSIONS:** Spending more time in moderate-to-vigorous physical activity was associated with enhanced self-control in young people with ADHD. Furthermore, higher physical fitness was associated with enhanced cognitive performance in this population and may be associated with higher resilience. These findings suggest that enhanced physical activity and fitness are important in young people with ADHD and could be an attractive intervention avenue in this population.

Bone Strength, Patellar Tendon Structure, and Maturation in Young Dancers With and Without PFP

Sitton, Y.*, Shenhar, M., Zafrani, R., Siev-Ner, I. & Steinberg, N.

*The Academic College Levinsky-Wingate (Wingate Campus), Netanya, Israel. ibex505@gmail.com

INTRODUCTION: A common diagnosis among girls and young women is Patellofemoral Pain Syndrome (PFP). The frequency of PFP raises from prepubertal (ages 8-11) to pubertal ages. Positive examination to PFP and continuous PFP injuries were found related to PFP injuries occur among dancers. Late pubertal and high load dance practices may lead to PFP injuries. Researchers examined the relationship between PFP and other variables, however this research examine different factors may cause PFP: bone strength, patellar tendon (PT) structure, maturation, and pubertal stage. This study aimed to examine the relation between PFP to the pubertal stage, PT structure, and bone strength in young dancers. **METHODS:** 33 dancers, ages 10-16, underwent an interview about dance history, and pubertal stage (Tanner stage), anthropometric measures assessed (weight, height, BMI, leg length). Bone strength, patellar tendon and musculoskeletal assessed by ultrasound (US) examinations, Quantitative US Speed of Sound (SOS), US Tissue Characterization (UTC) classify the tendon into four different types and Musculoskeletal US (MS), respectively. **RESULTS:** Bone strength measures found to be high ($p<.001$). UTC Echo-Type III+ IV ($p<.001$, $p=.003$ respectively) of the PT was lower comparing to dancers with PFP in Tanner \leq 2, and in comparison, to dancers with no-PFP in Tanner \leq 2. **CONCLUSIONS:** This research demonstrates the relation between PFP and anatomical properties of young dancers pre-pubertal and pubertal. The research represents high incidence of PFP among dancers' population, especially among pre-pubertal dancers, comparing to dancers in pubertal levels or post-pubertal. Therapists, physiotherapists, trainers, and dance teachers should aware the necessity in applying adequate training program and injury prevention strategy for the pre-pubertal dancers.

Patellofemoral Pain, Body Morphology and Alignment in Female Pubertal Dancers: One-Year Follow-Up

Steinberg, N.*, Elbaz, L., Sitton, Y., Zafrani, R., Shenhar, M. & Siev-Ner, I.

*The Academic College Levinsky-Wingate (Wingate Campus), Netanya, Israel. knopp@L-W.ac.il

INTRODUCTION: The maturation period is a critical time for young dancers, as it can be accompanied by critical changes in body morphology and in anatomical alignment, along with increased prevalence of patellofemoral pain (PFP) injuries. The purpose of this follow-up study was to assess changes in body morphology, in anatomical alignment and in the prevalence of PFP; and to identify the risk factors related to PFP in young dancers as they mature from early- to mid-adolescence. **METHODS:** Sixty dancers (aged 12.8 ± 0.5) in a special dance program at school were

screened in Grade 7 and 12 months later in Grade 8. In both years all the dancers were interviewed for background and training intensity data, and anthropometric measurements, lower limb physical examination and knee examination with musculoskeletal-ultrasound were performed. **RESULTS:** PFP was found in 53.3% of the dancers at baseline. At 1-year follow-up, 55.4% of dancers who were asymptomatic at baseline developed PFP, and only 9.5% of the dancers who were symptomatic at baseline recovered. Higher BMI; decreased knee joint ROM and decreased size of knee structures were identified among dancers who developed PFP during the follow-up period, compared with dancers with no PFP at baseline nor at follow-up. Positive grinding test and positive PIT test at baseline were found to be risk factors for PFP at follow-up. **CONCLUSIONS:** High prevalence of young dancers suffered PFP, injury that mostly sustain during one year of dance practice. Extrinsic and intrinsic parameters predisposing the dancers to PFP should be identified by screening in early stages of dance class. Dancers and teachers should be alert to the need for devising modifications of training and injury prevention strategies from a young age. Further prospective studies are needed to determine the relationship between the developing musculoskeletal anatomy and PFP onset; and, further studies are warranted to understand the causes of PFP along puberty.

An Evaluation of 'Footie Families' A Family Engagement Motor Skill Programme, To Support Children's Motor Competence and Family Physical Activity

Stevenson, A.*, Wainwright, N. & Williams, A.

*Wales Academy for Health & Physical Literacy, University of Wales Trinity Saint David, UK. a.stevenson@uwtsd.ac.uk

INTRODUCTION: Despite substantial growth in commercialised sports for children under 5, evidence highlights the importance of children accessing a broad range of fundamental movement skills (FMS) to support lifelong health-enhancing physical activity (PA) and positive health trajectories (Hulteen et al., 2018; Stodden et al., 2008). Footie Families is an evidence-based intervention supporting motor competence (MC) and family PA in children aged 2-5. **METHODS:** A mixed methods study evaluated the impact of Footie Families delivered by coaches within communities in Wales. Children were tested in MC with two tools, the Peabody Developmental Gross Motor Subscales (Peabody) (N=22) and the Athletic Skills Track-1 (AST) (N=32). To evaluate PA, parents completed a co-activity questionnaire (N=31). A process evaluation explored coaches' and parents' experiences through a qualitative methodology. **RESULTS:** Results indicated significant gains in children's MC in both tools. Parents reported higher scores for parent engagement, reinforced by qualitative findings, which noted that the programme enhanced quality family time and influenced the type of activities families engaged in. Parents perceived Footie Families to support children's broader development, including engagement and confidence. While families initially expected more football, stakeholders valued the multi-skill approach to enhance children's holistic development. **CONCLUSIONS:** This research indicates that motor skill programmes implemented by community coaches, using the power of sport with parental engagement, are effective in enhancing young children's MC and family PA, supporting the foundations for physical literacy.

Moving Our Feet to Make a Beat: Translating Physical Activity into Music to Aid Children's Understanding

Swain, T.A.*, McNarry, M.A., Knight, R.L., Summers, R., Farthing, A.L., Dietzig, R., MacDonald, D., Gatzemeier, J. & Mackintosh, K.A.

*Applied Sports, Technology, Exercise and Medicine (A-STEM) Research Centre, Swansea University, UK. 851760@swansea.ac.uk

INTRODUCTION: Young people often fail to meet government physical activity (PA) recommendations and lack awareness of their personal behaviours. Many current devices track PA but fail to fully capture and relay the quality or intensity. Multi-dimensional feedback is required to enhance awareness, understanding of, and engagement in, PA. This study investigated the perceptions of children and young people, teachers, parents, and musicians' regarding how to represent PA in a musical format to improve children's understanding and engagement. Contextual factors that may influence the future use of such feedback were also examined. **METHODS:** Children and young people, comprising 24 primary (10 girls; 4-11 years) and 24 secondary school (11 boys; 12-14 years) students, and 13 adults (3 male; 5 teachers, 4 parents and 4 musicians) participated in online semi-structured focus groups or individual interviews, respectively. Participant opinions on the definitions, measurement, motivations, and feedback of PA levels were explored. **RESULTS:** Qualitative Content Analysis revealed that: i) music was perceived as positive means to gain PA feedback; ii) children were enthusiastic to further engage; iii) children preferred individualised musical features (instrument, tempo, genre) for PA feedback; iv) teachers emphasised the importance of explanations regarding the use of music for PA feedback, though also expressed confidence in children's ability to understand feedback; v) instantaneous, daily, and weekly feedback frequencies were preferred, with options for individual choice recommended; and vi) parental involvement and the choice between collective and individual participation were identified as factors that may facilitate future engagement. **CONCLUSIONS:** Music offers a novel way to provide PA feedback to children and young people. Given the multitude of different options that music provides, individualisation could be key to its implementation as a feedback and engagement strategy.

Towards an Individualized Approach to Promoting Healthy Active Living: Conceptualization and Development of an Integrated Movement Index

Tremblay, M.S.*

*Healthy Active Living and Obesity Research Group, CHEO Research Institute, Ottawa, Canada; Department of Pediatrics, University of Ottawa, Ottawa, Canada. mtremblay@cheo.on.ca

INTRODUCTION: Compelling evidence suggests that through lifestyle decay we are mortgaging the health of children and youth. An accumulating evidence-base coupled with advanced analytics provide a platform for precision child health intervention processes that have potential to increase movement behavior prescription uptake. **METHODS:** Informed by an environmental scan, scoping review, systematic review and meta-analysis, and formative qualitative research, we use the integrated 24-hour movement paradigm as a conceptual platform to develop a Movement Index - a single, individualized metric that takes into account daily physical activity, sedentary behaviour and sleep, and related correlates (e.g., age, sex, gender, ethnicity, SES, health status). The Movement Index will operate through an app with machine learning generated scoring and recommendations for improvement. **RESULTS:** The Movement Index moves from an isolationist conceptualization (e.g., the importance of sleep or exercise or digital screen exposure) to a complex, integrated, individual model ("the whole day and each child matters") leading to precision insights and interventions, management and manipulations for improved child health and wellness. The environmental scan showed no similar instrument exists; the scoping review found compelling and consistent evidence of health benefits of combined movement behaviours; the systematic review

and meta-analysis of compositional data analysis studies relating integrated movement behaviours to health indicators provides an information platform for Movement Index calculations; draft wire frames have been developed and early formative surveys and focus groups suggest acceptability of the Movement Index and app architecture. **CONCLUSIONS:** The development of an integrated Movement Index shows promise as a precision medicine adjunct to promote and facilitate nudges toward healthier movement behavior combinations.

Determinants of Allometrically-Scaled Cardiorespiratory Fitness in Adolescents With Congenital Heart Disease

Wadey, C.A.*, Forsythe, L., Amir, N.A., Dorobantu, D.M., Pieleas, G.E., Stuart, A.G., Barker, A.R. & Williams, C.A.

*Children's Health & Exercise Research Centre (CHERC), University of Exeter, UK. cw694@exeter.ac.uk

INTRODUCTION: Young-people with congenital heart disease (ConHD) have reduced cardiorespiratory fitness (CRF), which has been associated with mortality and morbidity. Previous studies have explored the determinants of CRF using inappropriate ratio-scaling techniques and have not accounted for physical activity (PA). The aims of this study were to identify determinants of CRF in adolescents with ConHD. **METHODS:** Twenty-eight adolescents with ConHD (age 14.4 ± 1.7 y, 57% male) performed spirometry, echocardiography, a ramp-incremental cycle test to exhaustion, and had their PA measured via an accelerometer. CRF metrics were scaled to fat-free mass (FFM) via log-linear regression with sex added as a covariate. Multiple linear regression identified determinants of CRF. **RESULTS:** Participant age, sex, body fat percentage, ConHD complexity, and spirometry were not associated to peak oxygen uptake (peak $\dot{V}O_2$ mL·FFM^{1.181}·min⁻¹) or the oxygen uptake efficiency slope (OUES/FFM^{1.151}). New York Heart Association class III was negatively associated with peak $\dot{V}O_2$ (β =-11.5, p ≤0.01) and OUES (β =-14.1, p <0.01). Light, moderate, and vigorous PA (VPA) were all significantly and positively associated with CRF, but sedentary time was not. In multivariable models only VPA remained associated with peak $\dot{V}O_2$ (β =0.66, p =0.04). Severe left ventricular (LV) hypertrophy, moderate LV dysfunction and moderate LV pressure overload were negatively associated with CRF. Using a backwards selection multivariable model only moderate LV dysfunction remained significantly associated with CRF (p <0.01). In a final multiple regression model, VPA and moderate LV dysfunction were both independent predictors of CRF (peak $\dot{V}O_2$, VPA β =0.75, p <0.001; moderate LV dysfunction -6.52, p <0.01). **CONCLUSIONS:** Peak $\dot{V}O_2$ and OUES allometrically-scaled to FFM are clinically meaningful and were independently associated with PA and cardiac dysfunction. When clinically appropriate VPA should be promoted in paediatric ConHD.

Acute Cognitively Engaging Exercise Improves Subsequent Working Memory in Children With Attention Deficit Hyperactivity Disorder and Autism Spectrum Disorder

Walters, G.W.M.*, Sweeny, E., Williams, R.A., Cooper, S.B. & Dring, K.J.

*Sport, Health, and Performance Enhancement (SHAPE) Research Centre, Department of Sport Science, School of Science and Technology, Nottingham Trent University, Nottingham, United Kingdom. grace.walters@ntu.ac.uk

INTRODUCTION: Neurodevelopmental conditions, such as attention deficit hyperactivity disorder (ADHD) and autism spectrum disorders

(ASD) affect ~4% of children in England. Acute bouts of physical activity may improve cognition in this population, yet the modes of exercise examined often lack ecological validity and are not deemed suitable for children with neurodevelopmental conditions. Thus, the aim of the present study was to explore the effects of an acute bout of cognitively engaging exercise on cognitive function in children with ASD/ADHD. **METHODS:** Following familiarisation, 34 children (9.8±1.0 y) completed two experimental trials (30-min cognitively engaging exercise session vs. 30-min rest), separated by 7-d in a counterbalanced, crossover design. Executive function (Stroop task), working memory (Sternberg paradigm), and perception (visual search test) were assessed pre-, immediately post-exercise, and the following morning (30-min after a standardised breakfast). Accuracy and reaction time for each cognitive test were analysed via two-way repeated measures ANOVA. Participant diagnosis (ASD, ADHD, co-occurring) was included as a covariate. **RESULTS:** Working memory showed an improvement immediately post-exercise, whereby accuracy on the 3-letter level of the Sternberg paradigm was improved compared to rest (exercise: +4.69 ±14.85 % vs. rest: -7.07±17.40 %; trial*time, P=0.045). Attention, executive function (Stroop task), and perception (visual search) were not affected by the cognitively engaging exercise (all P>0.05). Diagnosis did not influence the effects of activity (all P>0.05). **CONCLUSIONS:** Acute cognitively engaging exercise improved working memory in children with ASD and/or ADHD but did not influence the inhibitory control aspect of executive function (Stroop task) or perception (visual search test). Deficits in working memory are linked to key ADHD symptoms (e.g., inattention, hyperactivity), thus these findings have important practical implications.

The Role of the Child's Voice in Practitioner Education: An Investigation Into a Play-Based Physical Literacy Education Programme in the UK

Wing, K.*, De Ste Croix, M., Roberts, W.M. & Baker, C.

*School of Natural, Social and Sport Sciences, University of Gloucestershire, UK. s2117488@glos.ac.uk

INTRODUCTION: It has been suggested that practitioner education could impact on children's Physical Literacy (PL) and Physical Activity throughout a lifetime (PA) [1], but this impact on learners through exploring the child's voice, is unknown. Boing is a workshop-based programme that aims to support practitioners to develop children's PL through active play. The aim of this study was to explore children's experiences within a wider multimethod evaluation. **METHODS:** Following the delivery and evaluation into the effectiveness of the Boing workshop with 926 practitioners (coach educators, teachers, coaches and volunteers) from 45 organisations data from 12 children associated with 4 practitioners (3 organisations) participated in Unfinished Stories. Unfinished Stories are a novel drawing-based interview approach utilised to explore the child's perspective of active play and PA following the intervention. Six stage thematic analysis was completed on both verbal and visual narratives in order to identify themes [2]. **RESULTS:** Three higher-order themes were identified: physical play, digital play and the environment with sub themes including sport, family, friends and learning. Six children identified technology when questioned on active play, eight identified family and/or friends while others described sport, games, challenges and learning moments. This greatly differed from the practitioner narrative explored in the previous study. **CONCLUSIONS:** Children had their own unique view of play that greatly differed from their adult counterparts appearing to place greater emphasis on digital play while practitioners valued 'traditional' physical play and the means to facilitate it. The role of digital play will likely increase as a component of physical activity and must be further explored to determine its role and function in this context.

Effect of Eccentric Training on Anthropometrics, Fitness and Bone Strength Among Children With Overweight and Obesity

Zafrani, R.*, Nemet, D., Eliakim, A. & Steinberg, N.

*The Academic College Levinsky-Wingate (Wingate Campus), Netanya, Israel. ravidzafrani123@gmail.com

INTRODUCTION: In the last three decades, there has been a significant increase in the prevalence of obesity among children that is related to an increase in daily caloric intake and a decrease in physical activity. The effect of an eccentric training program has not yet been tested in children in general and among obese children in particular. The purpose of this study was to examine the effects of an eccentric aerobic training program on physical fitness and physiological indicators among children who suffer from overweight and obesity. **METHODS:** 16 children aged 7-12 years (9.8±1.7) who are in the stage of pre-puberty and are overweight or obese (percentage rating of 94.9%±5.7%). Participants were randomly assigned into one of two groups. The participants performed 16 training sessions in 8 weeks, the training included aerobic physical activity at an intensity between 70-80% of maximum heart rate. The intervention group (n=8) performed an eccentric (ECC) training program and the control group (n=8) performed a concentric (CON) training program corresponding in intensity and loads to the intervention group. Pre-and post-tests were performed for anthropometric measures, bone strength assessment and physical fitness tests. **RESULTS:** All the participants showed a significant improvement in: 6 minutes walk test, 12 minutes run test, high jump, long jump, 10x4 running, general flexibility, right knee extensor and flexor strength, left knee extensor and flexor strength, and bone strength (p<0.01 for all tests). Group effect showed a significant increase in the 12 minutes run test for the ECC group (p=0.02). **CONCLUSIONS:** It seems that among overweight and obese children, no significant advantages were found for an eccentric training program compared to a concentric training program. Additional training programs involving this type of muscle contraction in the child population should be tested on a larger sample in order to confirm the data emerging from the study.

Exercise Parameters in Pediatric Patients With Multisystem Inflammatory Syndrome (MIS-C) Post COVID-19

Zucker-Toledano, M.*, Bentur, L., Butbul, Y. & Bar-Yoseph, R.

*Pediatric Cardiology Institute, Ruth Children's Hospital, Rambam Health Care Campus, Haifa, Israel; Pediatric Cardiology Unit, Hillel Yaffe Medical center, Hadera, Israel. meravz18@gmail.com

INTRODUCTION: Following the pandemic of the novel corona virus, a rare syndrome of Multisystem Inflammatory Syndrome in children (MIS-C) in association with post COVID-19 emerged. Data on functional capacity of children recovering from MIS-C COVID-19 with /without myocarditis using cardiopulmonary exercise testing (CPET) is scarce. **AIMS:** To investigate the effect of post MIS-C with and without myocarditis on cardiopulmonary and exercise parameters. **METHODS:** Patients discharged after admission for MIS-C between October 2020-June 2021 were included. Post MIS-C with and without myocarditis groups were compared. Exercise parameters were compared to age and sex matched healthy control. **RESULTS:** Out of 12 patients (10 M, mean 13.2±4 y), 7 had myocarditis (6 M, 13.6±4.2 y). Patients had normal cardiac evaluation at CPET visit (5.8±3.7-month post MIS-C (range 2-16 month)). Peak $\dot{V}O_2$ pred, anaerobic threshold (AT; as % of peak $\dot{V}O_2$) and peak O₂ pulse %pred were in normal range in both groups but significantly lower in the MIS-C (84.6±14.9%, 41.7±8.5%, and 85.9±15%) than in the control (116.5±22%, p<0.01, 54%±12.6, p=0.01 and 123.8±21.2%, p<0.01

respectively). All participants had normal HR and O₂ pulse dynamics, FEV₁ and FVC pre/post exercise (PFT), $\dot{V}E/\dot{V}CO_2$ slope, and SpO₂. In a subgroup analysis, peak $\dot{V}O_2\%$ and peak O₂ pulse% were normal in the MIS-C myocarditis (90.7±9.7% and 92±12.1%) and below normal in the MIS-C without myocarditis group (75.4±17.4%, p=0.07 and 77.6±16%, p=0.1 respectively). No difference was found for AT between groups (MIS-C related myocarditis 43.1±9.1% and MIS-C without myocarditis 39.8±8.3%, p=0.5). PFT, SpO₂ and $\dot{V}E/\dot{V}CO_2$ were normal in both subgroups. **CONCLUSIONS:** MIS-C exercise capacity was normal but lower than control in medium term follow up. Myocarditis didn't worsen MIS-C exercise capacity. No cardiac or respiratory significant limitation were demonstrated in any of the MIS-C patients.

Poster Abstracts

Associations Between Parent and Child 24-Hour Movement Behaviours During the Covid-19 Pandemic in Canada

Caldwell, H.A.T.*, Campbell, J.E., Preston, A., Kirk, S.F.L., Faulkner, G., Tremblay, M.S. & Moore, S.A.

*Health Populations Institute, Dalhousie University, Halifax, Canada. salome_aubert@hotmail.fr, hilary.caldwell@dal.ca

INTRODUCTION: As children develop healthy movement behaviours, parents can influence and support these behaviours. During the COVID-19 pandemic and associated public health restrictions, families spent more time together and parents may have had a greater influence on child movement behaviours. The purpose of this study was to determine the associations between parent and child movement behaviours and compliance with movement behaviour guidelines at two timepoints during the COVID-19 pandemic. **METHODS:** National samples of Canadian parents of children and youth (5-17 years-old) completed online surveys about their own and their child's movement behaviours in October 2020 (n=1568, 58% female) and April 2021 (n=1600, 60% female) during the COVID-19 pandemic. Associations between parent and child movement behaviours (physical activity, screen time, sleep) and compliance with movement behaviour guidelines (physical activity, screen time, sleep, 24-hour combined) were examined. **RESULTS:** We observed mostly positive, significant correlations between parent and child movement behaviours in October 2020 ($r=0.12-0.26$, $p < 0.05$) and April 2021 ($r=0.12-0.20$, $p < 0.05$). A parent meeting the individual movement behaviour guidelines was associated with an overall increased odds of their child meeting the guidelines in October 2020 (Odds Ratio (OR)=1.29-3.29) and April 2021 (OR=1.58-2.40), particularly for children (5-11 years) versus youth (12-17 years). Parents meeting the 24-hour movement guideline increased the odds of their child meeting the 24-hour movement guidelines in October 2020 (OR=3.29) in April 2021 (OR=2.40). **CONCLUSIONS:** Parent and child movement behaviours were associated with one another during the COVID-19 pandemic, particularly for children compared to youth and for 24-combined movement behaviour guidelines. In times of severe public health restrictions, health promotion efforts should target family units to collectively impact healthy movement.

Intra-Observer Reproducibility and Inter-Observer Agreement of Greulich-Pyle Protocol for Skeletal Age Determination Among Male Tennis Players 8–16 Years

Coelho-e-Silva, M.*, Celis-Moreno, J.M., Martinho, D.V., Sousa-e-Silva, P., Costa, D. C., Oliveira, T., Gonçalves-Santos, J., Ribeiro, L.P., Tavares, O.M., Konarski, J., Myburgh, G.K., Cumming, S.P. & Sherar, L.B.

*FCDEF, University of Coimbra, Portugal; CIDAF (uid/04213/2020), University of Coimbra, Portugal. mjcesilva@fcdef.uc.pt

INTRODUCTION: The assessment of biological maturation in youth sports is a central topic in pediatric exercise sciences. Skeletal age (SA) represents changes in each bone from initial ossification to the adult state. This study aimed to examine the intra-observer and inter-examiner agreement using the Greulich-Pyle (GP) protocol to determine SA among male youth tennis players. **METHODS:** The sample included 97 participants aged 8.6–16.8 years. Two observers independently examined all films twice using the GP method. The radiographs were examined using bone-by-bone inspection. The calculation of SA only considered the pre-mature bones of hand and wrist. Within each participant, individual SA was obtained via the mean and the median from S3As of all bones. **RESULTS:** Between time moments, observer A presented significant differences on 17 bones and observer B on five bones. Comparison between observers evidenced differences for the ulna, metacarpal II-III, and distal phalange. Nevertheless, the significance of the preceding dependent variables was marginal and the magnitude effect always trivial. The SA differences between observers were negligible when calculations were performed adopting the mean (0.04±0.39, $t=0.321$, $p=0.749$) or the median (0.05±0.58, $t=0.007$, $p=0.994$). **CONCLUSIONS:** The current study examined 100 observations as part of a training program. Although some discrepancies within and between examiners on specific bones, the individual SA did not differ independently of adopting the mean or the median from pre-mature bone-specific SAs.

Exploring Barrier and Facilitators to Delivering Movement Competency in Youth Sport Coaches and Physical Education Teachers in Saudi Arabia

De Ste Croix, M.B.A.*, Ayala, F., Hughes, J.D., Wing, K., Roberts, W.M.

*School of Natural, Social and Sports Sciences, University of Gloucestershire, UK. mdestecroix@glos.ac.uk

INTRODUCTION: There is strong evidence that injury prevention programmes can reduce injury risk and improve physical characteristics in youth sport, yet programme awareness, uptake, and adherence are often poor. The aim of this study was to investigate perceived barriers and facilitators to adopting, implementing, and maintaining an injury prevention programme through an inductive, qualitative lens. **METHODS:** 8 grass-root coaches and PE teachers from the Kingdom of Saudi Arabia were recruited from a wider sample (n=56) who had completed a 2-hour injury prevention workshop. Interviews took place 3-4 months after completion of the workshop. An interview schedule exploring barriers and facilitators to adoption, implementation, and maintenance of the movement competency programme was explored. Lichtman's approach to the 3 C's was used to identify common and shared experiences of deploying the information presented in workshops in the practitioner context. **RESULTS:** Three themes were identified as perceived barriers (time, ongoing resources, and further training/certification), and facilitators (tutor knowledge, website and current resources, new knowledge and confidence). The concept of support from federations was a strong theme. A strong perceived barrier was that a lack of accreditation would reduce uptake. The tutor knowledge and 'clear and expert' delivery of the workshop increased adoption of the programme. As specialists some practitioners felt comfortable with the topic but appreciated the range of materials available to support them. **CONCLUSIONS:** Stakeholders buy-in and accreditation are key to successful adoption and implementation of injury prevention programmes. Continued coach education would empower coaches to make decisions regarding session content; reinforce their ability to deliver preventative programmes without extensive

resource; whilst improving knowledge and confidence to educate youth athletes about the importance of injury prevention.

The Difference in Motor Skill Performance of Boys and Girls Aged Six- to Eight-Years-Old in the North West Province of South Africa. Perf-Fit Study

du Plessis, A.M.*, du Plessis, R., Duvenhage, M., van der Merwe, M., Coetzee, D.

*Physical Activity, Sport and Recreation Entity, North-West University, SA. alretha.duplessis@nwu.ac.za

INTRODUCTION: Well-developed motor skill performance provides children with the ability to perform a movement in a skilled manner and is important for participation in daily living activities. Consequently, children with inadequate motor skill performance will have detrimental outcomes on their academic success and physical development. Contradictory information on the prevalence of motor skill performance among boys and girls aged six- to eight years old, exists. Therefore, the aim of this study was to explore gender differences regarding the motor skill performance of children aged six- to eight-years-old in the North West Province of South Africa. **METHODS:** A cross-sectional design was used and 108 children between the ages of six- to eight-years-old participated in the study. The Performance and Fitness (PERF-FIT) test battery was used to determine the children's motor skill performance. **RESULTS:** The majority of the children fell in the average category for their skill item series (SIS). The results showed that there was no statistical significance difference found between the boys' and girls' motor skill performance. However, a small to moderate difference was found in the Bounce and Catch ($d=0.37$), Static Balance ($d=0.33$), and Dynamic Balance ($d=0.53$), in the six-year-old group, where the girls outperformed the boys each time. Dynamic Balance ($d=0.45$), was the only skill where the girls outperformed the boys by a small effect in the seven-year-old group and there was a small effect where the boys outperformed the girls in Bounce and Catch ($d=0.29$), Throw and Catch ($d=0.34$), and Hopping ($d=0.32$) in the eight-year-old group. Lastly, the girls outperformed the boys in the Dynamic Balance ($d=0.32$), although only by a moderate effect in the whole group. **CONCLUSIONS:** The findings indicated that boys and girls performed similarly with their motor skill performance. Therefore, the same developmental programs can be provided to improve motor skill performance.

Effect of Growth and Maturation on Technical Skill Development in Youth Soccer Players

Hidalgo-Mazzei, A.*, Erlandson, M.C., Humbert, M.L., Baxter-Jones, A.D.G.

*College of Kinesiology, University of Saskatchewan, Canada. aaron.hidalgo-mazzei@hotmail.com

INTRODUCTION: Although, it has been shown that growth and maturational influence performance, less is known about its effects on skill development. Skill is the learned ability to bring about pre-determined results with maximum certainty. Traditionally, skill has been assessed subjectively however objective measures, such as the Loughborough Soccer Passing Test (LSPT) have been developed. The LSPT can distinguish various components of skill performance between players of different abilities. What is unknown is the role that growth and maturation may play on skill performance in the LSPT. **METHODS:** A sample of youth soccer players aged 9 to 15 years of age were recruited from ASTRA Soccer Academy, Saskatoon. Soccer descriptives were collected by questionnaire. Anthropometric measures included height, sitting height,

weight, and fat composition (Tanita DC-13C). Chronological age (CA) was determined from date of birth and measurement date. Biological age (BA) was estimated using an anthropometric equation to predict age from attainment of peak height velocity (PHV). The Loughborough Soccer Passing Test (LSPT) was used to assess soccer-specific technical skills. Skills were assessed in a designated area and time to complete with penalties was recorded, the lower the time the higher the technical skills rating. Data were analysed with descriptive statistics and correlations. **RESULTS:** 43 players were recruited (11 males and 32 females). CA range was 9.6 to 15.2 yrs and BA -2.9 to 2.9 yrs from PHV. Average years of training was 5.2 ± 2.7 yrs. No significant sex effect on LSPT was found ($p>0.05$). LSPT time decreased with increasing CA ($r = -0.46$), BA ($r = -0.28$), height ($r = -0.40$), and years of training ($r = -0.51$) ($p<0.05$). **CONCLUSIONS:** The results suggest that skill acquisition is associated with children's growth and maturation. This suggests that coaches should consider a player's growth and maturational status when objectively identifying a soccer player's skill.

Movement Behaviours and Bone Health in Adolescents: A Compositional Analysis of Alspac Study

Huang, R.*

*The Children's Health & Exercise Research Centre, Faculty of Life and Health Sciences, Exeter University, UK. rh646@exeter.ac.uk

INTRODUCTION: While bone development and the achievement of PBM are genetically determined, lifestyle factors such as movement behaviours affect the achievement of genetic potential. The overall purpose of this cross-sectional study is to investigate the combined effect of time spent in physical activity and sedentary behaviours that together constitute a composite whole on bone parameters within a compositional analysis framework. **METHODS:** Data on participants who attended clinical assessments at 15 years of age in the Avon Longitudinal Study of Parents and Children cohort were used. Waking-hour accelerometer data to determine the time spent in sedentary behaviours, light physical activity, and moderate physical vigorous physical activity. A compositional analysis framework is used to analyze associations between time spent in different movement behaviours) and bone mass and strength. **RESULTS:** In total 2335 adolescents (56% females) were included after sample screening. The time spent in sedentary behaviours and light physical activity has relatively low variability (the variance in \ln (sedentary time)/ (light physical activity) is 0.14). Whole body less head BMC were positively associated with MVPA but negatively associated with LPA. **CONCLUSIONS:** It is identified the positive effect of MVPA relative to the other behaviours on bone mass.

Movement Behaviours and Bone Health in Children and Adolescents: A Narrative Review

Huang, R.*

*The Children's Health & Exercise Research Centre, Faculty of Life and Health Sciences, Exeter University, UK. rh646@exeter.ac.uk

INTRODUCTION: Although osteoporosis usually manifests itself after the fifth decade of life, the attainment of peak bone mass within the first three decades is known to be the crucial determinant of lifelong skeletal health. This narrative review is aimed to explain the patterns of bone growth in early life, provide an updated summary of the associations of movement behaviours (physical activity, sedentary behaviours, and sleep) with bone health in school-age children and adolescents, and explore appropriate future research directions based on the knowledge gaps.

METHODS: The search was carried out utilizing Google Scholar, PubMed, and Web of Science databases. The preliminary search terms included: (“bone” or “bone density” or “bone strength” or “bone mass” or “bone structure”) and (“children” or “adolescents”). In order to conduct more targeted search for each section, the above search terms were combined with other specific terms such as “physical activity”, “sedentary behaviours”, “sleep” or “movement behaviours”. Manually searching of reference lists of potentially eligible studies was undertaken to identify additional studies relevant to this topic. **RESULTS:** Bone growth is a three-dimensional process and bone mass acquisition during growth is determined by the growth in bone size and the change in bone density. Weight-bearing moderate-to-vigorous physical activity contributes to bone health during growth. Puberty, nutrition, and lean mass can affect the relationship between physical activity and bone health. Meanwhile, sedentary behaviours (total sedentary time, different sedentary patterns and types) and sleep (adequate amounts of appropriately timed sleep) seem to have different influences on bone health. There have been emerging studies focused on the combined effects of these movement behaviours on health indexes including parameters of bone health. **CONCLUSIONS:** Movement behaviours are modifiable factors to affect bone health during growth.

Impact of Sprint Interval Training on Cardiometabolic Health Indices in Adolescent Boys With Obesity

Salus, M., Tillmann, V., Rimmel, L., Unt, E., Mäestu, E., Mägi, A., Tali, M., Jürimäe, J.*

**Institute of Sport Sciences and Physiotherapy, University of Tartu, Estonia. jaak.jurimae@ut.ee*

INTRODUCTION: It has been suggested that in contrast to moderate-intensity continuous training, interval training protocols characterized by high exercise intensity and short duration exercise bouts are more enjoyable for obese youth. This study examined the effect of a supervised 12-week sprint interval training (SIT) on body composition and cardiorespiratory fitness (CRF) in adolescent boys with obesity. **METHODS:** Twenty-eight untrained adolescent boys with obesity were assigned to either an intervention (SIT) (13.1 ± 0.3 yrs; BMI: 30.3 ± 3.2 kg/m²; body fat%: 41.1 ± 1.3 %) or a control (CONT) (13.7 ± 0.4 yrs; BMI: 32.6 ± 5.9 kg/m²; body fat%: 39.6 ± 1.9 %) groups. The SIT group performed 4-6 x 30 s all-out cycling sprints, interspersed with 4 min of recovery 3 sessions a week for 12 weeks, while the non-exercising CONT group maintained a habitual lifestyle. Body composition was measured by dual-energy X-ray absorptiometry and CRF was assessed by direct peak oxygen consumption (VO₂peak) defined as VO₂peak per kg of lean body mass (ml/min/LBM) before and after the 12-week intervention period. **RESULTS:** The post-intervention measurements revealed a significant reduction in body fat% by $1.2 \pm 0.6\%$ ($p=0.006$) in the SIT group and an increment in body fat% by $0.5 \pm 0.6\%$ ($p>0.05$) in the CONT group. CRF increased in the SIT (5.2 ± 1.1 ml/min/LBM; $p<0.0001$) compared to the CONT group (-2.1 ± 1.1 ml/min/LBM; $p>0.05$). In addition, a progressive increase in power output of training load (Week 1-4: 5.8 ± 0.4 W/kg; Week 9-12: 7.0 ± 0.6 W/kg; $p<0.05$) was observed. **CONCLUSIONS:** Supervised 12-week SIT intervention is effective in decreasing body fat% and increasing.

Using Technology-Driven Intergenerational Contact to Target Physical Activity and Health During the COVID-19 Pandemic: An Instrumental Case Study

Knight, R.L.*, Chalabaev, A., Mackintosh, K.A., McNarry, M.A., & Hudson, J.

**Applied Sports, Technology, Exercise and Medicine (A-STEM) Research Centre, Swansea University, UK; Univ. Grenoble Alpes, SENS, 38000 Grenoble, France. rachel.knight@swansea.ac.uk*

INTRODUCTION: Intergenerational contact offers an under-explored strategic approach to challenge age stereotypes and positively influence health behaviours in older adults and children. It is postulated that through the application of the constructs of Contact Theory, an effective platform for change could be established. Using an instrumental case study, the experiential effects of the phenomenon of intergenerational contact were pragmatically explored from the perspective of a single familial dyad. **METHODS:** Semi-structured interviews were conducted with each participant (61-year-old female; 9-year-old boy) during, and following, engagement with a remote, 12-week, technology-driven physical activity intervention focused on using daily step-counts to collaboratively complete virtual walk routes. Participation coincided with the first COVID-19 nationwide lockdown in the United Kingdom. **RESULTS:** Through reflexive thematic analysis and interpretation of the data in line with the study aim and propositions, four core themes were identified: Reciprocal Encounter (mutual benefits, forging new and cementing connections, special and positive experiences); Opportunity for Reflection and Re-evaluation (reflection, evaluation); Platform for Change (challenging stereotypes, behavioural motivation and changes, breaking barriers); and COVID-19 (limitations, physical activity awareness, supporting physical and mental health, sense of purpose, achievement). **CONCLUSIONS:** In addition to the perceived positive effects on targeted outcomes (physical activity, sedentary time, age stereotypes), facilitating intergenerational contact, through virtual methods, could counteract the detrimental health and well-being implications of loneliness and establish connections that could bring further gains.

Resources Within a Child's Environment Supported Physical Activity During the COVID-19 Pandemic: A Qualitative Description Approach

Locke, M.*, Spencer, R.A., Stone, M.R., MacDonald, C., Preston, A., Rehman, L., Kirk, S.F.L., Faulkner, G., Tremblay, M.S., Moore, S.A.

**School of Health and Human Performance, Dalhousie University, Halifax, Canada. maggie.locke@dal.ca*

INTRODUCTION: Characteristics of healthy communities include vibrant public spaces, ample community resources, and walkability. Health-promoting communities tend to promote children to engage in more physical activity and less sedentary behaviour. The COVID-19 pandemic led to public health restrictions which resulted in the closure of many community spaces and reduced community resources. The purpose of this study was to qualitatively explore the perspectives of parents on the impacts of community spaces, supports, and services on their child's physical activity and sedentary behaviour during the COVID-19 pandemic. **METHODS:** This study used a qualitative description approach. This approach focuses on describing the lived experience of participants using their own terms and voices and is less interpretative compared with other qualitative methods. Parents ($n=40$) of children aged 5-11 years living in Nova Scotia, British Columbia, and Ontario, Canada, were recruited to participate in semi-structured interviews. The data were analyzed using reflexive thematic analysis, informed by Braun and Clarke. **RESULTS:** Four themes were constructed to highlight the influence of community spaces on the physical activity and sedentary behaviour of children during the COVID-19 pandemic: 1) Public health restrictions caused a shift from community to personal responsibility, 2) Family adaptability and optimism were apparent amidst chaos, 3) When children came indoors the screens took over, 4) Loosening public health restrictions

improved access to community spaces, supports, and services. Themes were organized by settings, within the child's home and community spaces. **CONCLUSIONS:** Public health restrictions limited children's access to their community. Strategies are needed to improve availability of community spaces, supports, and services during future health crises to preserve children's healthy movement.

Gravitational Vs. Muscle Forces and Bone Properties Among Male Adolescents: ABCD – Growth Study

Luiz-de-Marco, R., Baptista, F., Narciso, P.H. & Fernandes, R.A.*

*Laboratory of Investigation in Exercise - LIVE, Department of Physical Education, Sao Paulo State University - UNESP, Presidente Prudente, Brazil. rafael.marco@unesp.br

INTRODUCTION: Sports participation and body composition have a relevant impact on bone health. The interaction between gravitational forces and muscle forces plays a crucial role in shaping bone properties. During developmental stage, the skeletal system undergoes significant (re)modeling and adaptation in response to mechanical loading. Understanding the intricate relationship between gravitational forces, muscle forces, and bone properties is of utmost importance in optimizing bone health. The aim of this study was to analyze gravitational and muscle forces' main and interaction effects on bone material and structural properties. **METHODS:** The sample consisted of 67 male youth aged 11 to 18 years divided according to the usual level of ground reaction force (non-athletes; athletes from non-weight bearing sports - swimming; athletes from weight bearing sports - judo, karate, kung-fu, basketball, baseball, tennis, and athletics), and lean body mass index (LBMI, low, average and high). Bone variables included whole body less head (WBLH) and lower limbs bone mineral density (BMD), section modulus (SM), cross-section moment of inertia (CSMI), and cross-sectional area (CSA) of the femoral neck. LBM and bone variables were assessed by dual-energy X-ray absorptiometry. **RESULTS:** Analysis of covariance adjusted for somatic maturity and body height revealed that swimming athletes have lower values in all structural bone measurements and BMD of the lower limbs than the other two groups ($p < 0.05$); no differences were observed between the non-athletes and weight-bearing athletes groups. In turn, differences were observed in all bone variables, except WBLH BMD, between groups with lower, average, and high LBMI ($p < 0.05$). No interactions were observed between sport participation and body composition. **CONCLUSION:** Muscle strength expressed through the LBMI was more relevant to hip geometry and lower limbs BMD than ground reaction force attributed to weight-bearing sports participation in boys.

Allometric Scaling of Girls' Musculoskeletal Fitness: The Rush Study

Maia, J.A.R.*, Pereira, S., Garganta, R., Vasconcelos, O., Garbeloto, F., Guimarães, E., Santos, C., Pacheco, M., Hedeker, D., Barreira, T., Go T., Katzmarzyk, P.

*CIFID2, Faculty of Sport, University of Porto, Portugal. jmaia@fade.up.pt

INTRODUCTION: Children differ in their physical growth, as well as in their physical fitness levels. There is evidence that girls are less fit than boys. Further, musculoskeletal fitness (MSF) is apparently dependent on children's body size and shape. We used allometric scaling to explore girls' MSF controlling for physical activity levels and biological maturation. **METHOD:** The RUSH study aims to investigate children's growth and motor development after the covid-19 pandemic. We used data from 170 girls aged 9.76 ± 0.45 yrs. Height, sitting height, and body mass were

measured, moderate-to-vigorous activity (MVPA) was obtained via Actigraph GT3X-BT during 7 consecutive days, and biological maturation was estimated with the maturity offset. MSF was assessed with three tests: handgrip (static strength), standing long jump (explosive strength), and 50-yard-dash (speed). Allometric scaling considered, simultaneously, height and body mass (crude analysis) as well as MVPA and biological maturation as covariates (adjusted analysis). All calculations were done in STATA v.18. **RESULTS:** Girls' allometric scaling exponents for height and body mass remained relatively similar even when the analysis considered the two covariates (from crude to adjusted). In handgrip, the exponents were: mass-0.262-height 1.957; in standing long jump, mass-0.472-height 1.904; and in 50 yard-dash, mass-0.309-height 1.405. Biological maturation was not a significant covariate ($p > 0.05$), and MVPA was only relevant ($p < 0.05$) in the 50 yard-dash. **CONCLUSION:** Taller and lighter girls tend to be fitter in running speed and explosive leg strength, but taller and heavier girls show more static strength. Biological maturation is not significant in MSF beyond girls' body size/shape, and MVPA was only relevant in agility. In sum, the most important predictor of girls' MSF is a proper relationship between body size and shape.

Health and Physical Fitness Indicators in Young Portuguese Volleyball Players

Paulo, A.*, Pereira, S., Santos, C., Aleixo, P., & Teixeira, D.

*CIDEFES, Faculty of Physical Education and Sports, Lusófona University, Lisbon, Portugal. ana.paulo@ulusofona.pt

INTRODUCTION: Higher physical activity levels decrease the risk of overweight and obesity in both adolescents and adults. Nonetheless, available evidence is unclear on whether sports programs protect youth from becoming overweight or obese. We aimed to: (1) identify the prevalence of overweight in Portuguese female volleyball players, and (2) analyse differences in physical fitness (PF) and movement quality (MQ) between normal-weight and overweight female volleyball players. **METHODS:** A total sample of 113 female volleyball players (Mean=15.4; SD=2.1; Min= 12; Max=24 years) were classified as normal or overweight according to WHO age-related cut-off points. PF was evaluated based on five tests. Individual z-scores, adjusted for age, were computed for each test. Then, aggregated z-scores for motor (shuttle run and 30 meters run), muscular (hand-grip and counter-movement jump), cardio-respiratory (three minutes step test), and overall PF were obtained. MQ was evaluated using deep squat and hurdle step tests of the Functional Movement Screen battery. We compared normal and overweight players PF with independent sample test, and their association with MQ with Chi-square test. Cohen d was considered for effect size. **RESULTS:** The prevalence of overweight players is 19.6% (N=17). There were no significant differences between normal weight and overweight players in muscular and motor components, and overall PF (Muscular: $t = -1.901$; $p = .06$; $d = .04$; Motor: $t = 1.543$; $p = .136$; $d = .04$; Overall: $t = .508$; $p = .617$; $d = .14$). However, normal-weight players were significantly better in the cardio-respiratory component ($t = 2.984$; $p = .004$; $d = .74$). Finally, MQ was not associated with weight status ($p > .05$). **CONCLUSIONS:** One in every five players is overweight, which significantly impacts their cardio-respiratory fitness. Future research and intervention should take these results into account and promote strategies targeting overweight and cardio-respiratory fitness.

Relationship of Physical Activity and Time Spent Sedentary to Weight Status and Body Fat Distribution in Pre-Schoolers: Results From the International Children Accelerometry Database (ICAD)

Peral-Suárez, A.*, Pearson, N., Sherar, L.B.

*School of Sport, Exercise & Health Sciences, Loughborough University, UK; Department of Nutrition and Food Sciences, Universidad Complutense de Madrid, Spain. A.Peral-Suarez@lboro.ac.uk

INTRODUCTION: Early childhood is an important period for the establishment of healthy lifestyle behaviours (e.g., adequate physical activity (PA) and low levels of sedentary time (ST)) to prevent obesity. However, due to the differences in the methodologies and measures used in previous studies, the relationship between PA, ST and markers of adiposity are unclear in preschool populations. **METHODS:** Cross-sectional data from 6 studies containing data on markers of adiposity and accelerometry data in pre-school children ($n=1071$, 4.19 ± 0.49 years) were extracted from the ICAD. Linear and multinomial logistic regressions were used to assess the relationship between the percentage (%) of time spent sedentary and in light PA (LPA), or moderate-to-vigorous PA (MVPA) and weight status and waist-to-height ratio (WtHR; subsample $n=510$). **RESULTS:** Less than a fifth (16.62%) of the sample were overweight or obese, and the mean WtHR of the subsample was 0.49 ± 0.03 . Boys spent less time sedentary ($p=0.007$) and more time in LPA ($p=0.009$) and MVPA ($p<0.001$) than girls. In boys, higher %MVPA was associated with lower likelihood of being overweight/obese (Coeff. = -0.056; 95%CI = -0.017 – (-0.006)), and with a lower WtHR (Coeff. = -0.056; 95%CI = -0.017 – (-0.006)). No significant associations were found among girls, or between ST or LPA and markers of adiposity. **CONCLUSIONS:** From an early age, boys were more active and less sedentary than girls. MVPA seems to be related to weight status and body fat distribution in preschool boys. Further longitudinal studies are needed to examine if PA at preschool age may also be related to weight status and body fat distribution in girls as they age. **ADDITIONAL INFORMATION:** The pooling of the data was funded through a National Prevention Research Initiative grant (G0701877) and Peral-Suarez A., has a Ministerio de Universidades-Margarita Salas fellowship funded by the European Union – NextGenerationEU.

Assessment of Skeletal Age in Male Tennis Players: Comparison of FELS and Greulich-Pyle Protocols

Martinho, D.V.*, Celis-Moreno, J.M., Sousa-e-Silva, P., Costa, D. C., Oliveira, T., Gonçalves-Santos, J., Ribeiro, L.P., Tavares, O.M., Konarski, J., Myburgh, G.K., Cumming, S.P., Sherar, L.B., Coelho-e-Silva, M.J.

*FCDEF, University of Coimbra, Portugal; CIDAF (uid/04213/2020), University of Coimbra, Portugal. dvmartinho92@hotmail.com

INTRODUCTION: Allowing for variation in protocols and reference samples, methods to determine skeletal age (SA) are not equivalent. The purpose of the current study was to compare SA assessment based on FELS and Greulich-Pyle (GP) in a cross-sectional sample of male tennis players. **METHODS:** The sample included 97 male tennis players aged 8.7-16.8 years. Standardized radiographs of the left hand-wrist were obtained and analysed by an experienced observer. Data quality associated with Fels and GP methods was published elsewhere (Sousa-E-Silva et al., 2022, Faustino-da-Silva et al., 2020). Players were classified as late, on time or early based on the difference between SA and CA. **RESULTS:** Fels SA was reduced compared with GP SA in early adolescence; mean differences ranged -0.15 to -0.20 years. Afterwards, GP SAs lags behind Fels. Differences between protocols were significant in middle adolescence: 13 years (mean difference: 0.79, $p<0.01$, $d=0.56$), 14 years (mean difference: 0.61, $p<0.01$, $d=0.52$) and 15 years (mean difference: 0.55, $p<0.01$, $d=0.32$). Agreement of maturity classifications between methods was 61% (95% CI: 51 to 71; $\kappa=0.26$, $p<0.01$). **CONCLUSION:** The current study highlighted intraindividual variability in SAs between methods which in turn has impact on estimations of maturity status.

Is the Association Between Physical Activity and Body Mass Index Mediated By Physical Fitness in Primary School Children?

Pereira, S.*, Katzmarzyk, P.T., Garganta, R., Vasconcelos, O., Garbeloto, F., Guimarães, E., Santos, C., Santos, R., Gomes, P.P., Borges, R., Hedeker, D., Barreira, T., Go T., Chaput, J.P., Maia, J.

*CIF2D, Faculty of Sport, University of Porto, Portugal; CIDEFES, Lusófona University, Lisbon, Portugal. sarasp@fade.up.pt

INTRODUCTION: Children with higher PA levels are more likely to display lower BMI. Furthermore, physically fit children tend to be more active than their unfit peers. This study investigated whether physical fitness (PF) mediates the link between moderate-to-vigorous physical activity (MVPA) and BMI in children. **METHODS:** The cross-sectional sample comprised 1075 Portuguese children (557 girls) aged 6-10 years from the REACT project. MVPA was obtained via accelerometry during 7 consecutive days. BMI was computed using the standard formula, and PF was assessed with the standing long jump, handgrip strength, shuttle-run, 50 yards dash, and the PACER. Individual sex-specific z-scores, adjusted for age, were computed, and then summed to obtain an overall PF score. Sex-specific path models were estimated to determine whether PF mediated the link between MVPA and BMI. All analyses were done using the PROCESS macro with SPSS (v.28). **RESULTS:** The results were similar in both boys and girls, that is, the total association between MVPA and BMI was significant (boys: $b=-0.022 \pm 0.004$; girls: $b=-0.022 \pm 0.005$) as was also the mediating PF effect ($b=-0.006 \pm 0.002$). The direct association was also significant in boys ($b=-0.017 \pm 0.004$) and girls ($b=-0.016 \pm 0.005$). Furthermore, 22% and 25% of the MVPA effect on BMI was mediated by PF in both boys and girls, respectively. **CONCLUSIONS:** There is evidence that PF mediates the link between MVPA and BMI in school-children, i.e., children with higher MVPA levels and more physically fit tend to display lower BMI. This highlights the importance of physical fitness education during the primary school years.

Assessment of Cardiorespiratory Fitness in an After-School Sports-Bases Youth Development Program

Siegel, S.R.*, Jun, D., Sheh, R. Casas Mejia, N., & Cooper, S.L.

*Department of Kinesiology, University of San Francisco, USA. ssiegel@usfca.edu

INTRODUCTION: Many after-school programs encourage youth to engage in physical activity (PA) to improve physical and psychological health. America SCORES Bay Area® is a sports-based youth development program that partners with local schools in low-income neighbourhoods to implement after-school programs that integrate soccer, poetry, and service learning. SCORES® participants write and share poetry, practice and play interscholastic soccer games, and organize community projects. Given the desire to increase overall health and well-being of youth, particularly those who are under-served, the focus of this pilot study is on the impact of SCORES® and whether health benefits are obtained and maintained by participants. **METHODS:** Assessment of cardio-respiratory fitness of SCORES® participants via the PACER (Progressive Aerobic Cardiovascular Endurance Run) was the focus of this research. Participants' mean age was 8.84 ± 1.45 yrs (3rd and 5th grades, 6-11 yrs). Although the total sample was 52 (19 females) for the pre- test and 47 (21 females) for the post test, only 25 completed both pre- and post- program measures. The PACER was assessed preseason (Fall 2022) and post-season (May 2023). **RESULTS:** Pre- to post-season PACER laps increased significantly: 12 ± 5.5 vs 17 ± 8.9 , respectively ($t=3.07$, $p=0.005$). No sex differences were found in this sample; however, males significantly

increased their number of laps from pre-to post assessment ($p < 0.05$). Males ran 10 ± 3.7 laps preseason and 16 ± 8.9 laps post; females ran 15 ± 7.4 and 18 ± 9.6 , respectively. **CONCLUSIONS:** In this preliminary work with SCORES©, participants increased their number of PACER laps from pre-post season. Future work includes assessing psycho-social parameters and using fitness data to give direction and guidance to service delivery providers (i.e., SCORES© and the local public schools) on the benefits of this type of program for under-served youth.

Short Sleep, Low Cardiorespiratory Fitness and Overweight Are Associated With Elevated Blood Pressure in Portuguese Children and Adolescents

Silva, G.*, Carvalhinho Silva, A., Estima, F., Lagoa, M.J. & Aires, L.

*Research Centre in Sports Sciences, Health Sciences and Human Development (CIDESD), University of Maia (UMAia). gugonsilva@gmail.com

INTRODUCTION: This study aimed to analyse associations between sedentary behaviours, physical activity, sleep, cardiorespiratory fitness and elevated blood pressure in children and adolescents. **METHODS:** Participants were 662 youths aged 10-18 years old (14.8 ± 2.6 y; 54.2% girls). Sedentary behaviours (SB) were measured by questionnaire, estimating time spent in personal computers for study or leisure, tablets, smartphones, social networks, watching television and sitting. Cut-offs of 2 hours per day for screen time or 8 hours per day for sitting were considered SB. Physical activity (PA) was assessed by questionnaire (IPAQ-short) and classified according to international PA guidelines into inactive and active. Pittsburgh Sleep Quality Index (PSQI) was assessed by questionnaire and sleep quality levels were defined following PSQI standards. Less than 8 hours per day was assumed as short sleep. Twenty meters shuttle run test was used to assess cardiorespiratory fitness and classified according to Portuguese standards. Resting systolic and diastolic blood pressures were measured following standardized procedures. Elevated blood pressure (EBP) was classified according to international standards. Chi-square and logistic regressions were used to analyse associations. **RESULTS:** Elevated blood pressure was associated with being overweight ($\chi^2=13.217$; $p < 0.001$; OR=1.900; 95%CI=1.341-2.693), being unfit ($\chi^2=21.186$; $p < 0.001$; OR=2.128; 95%CI=1.539-2.942), or short on sleep ($\chi^2=15.346$; $p < 0.001$; OR=1.888; 95%CI=1.317-2.598). No direct associations were found between EBP, PA and SB. **CONCLUSION:** These results suggest that Portuguese children and adolescents that are overweight, unfit and sleep less than 8 hours per day are in greater risk for elevated blood pressure, which might lead to poor cardiovascular health later in life. This study was supported by the Portuguese Foundation for Science and Technology, FCT, under the project UIDB04045/2020.

Impact of the Active Healthy Kids Global Alliance Global Matrix 1.0 to 4.0 – Building a Legacy of Success

Tremblay, M.S.*, Demchenko, I. & Aubert, S.

*Active Healthy Kids Global Alliance, Ottawa, Canada; Healthy Active Living and Obesity Research Group, CHEO Research Institute, Ottawa, Canada; Department of Pediatrics, University of Ottawa, Ottawa, Canada. mtremblay@cheo.on.ca

INTRODUCTION: The Active Healthy Kids Global Alliance (AHKGA) is an international not-for-profit organization of researchers, health professionals, and stakeholders working together to advance the physical activity of children and adolescents around the world. The dominant effort of the AHKGA to date has been its Global Matrix (GM) initiative. **METHODS:**

The GM initiative involves the collaboration and cooperation of multiple jurisdictions working together to produce country report cards on the physical activity of children and adolescents, following a harmonized process that allows for comparability, cross-fertilization of ideas to improve the grades, global networking, and the compilation and aggregation of international data across a series of indicators related to the physical activity of children and adolescents. **RESULTS:** To date, >70 countries/jurisdictions have registered for the GM initiative at least once. GM 1.0 (2014, 15 countries, 147 experts), GM 2.0 (2016, 38 countries, 349 experts), GM 3.0 (2018, 49 countries, 512 experts), and GM 4.0 (2022, 57 countries, 682 experts) were released in Toronto, Bangkok, Adelaide, and Abu Dhabi, respectively. Country report cards have been shown to be very effective and influential across multiple sectors (e.g., academia, research, education, recreation, health, policy, surveillance, and fundraising) for creating awareness; transferring interventions, policies, and practices; improving surveillance; and advocacy purposes. More than 300 presentations, 200 publications, and 6000 citations have been accrued from the report cards release. Partnership agreements with international groups have been established to synergize collaborative efforts to “power the movement to get kids moving” around the world. **CONCLUSIONS:** The AHKGA has demonstrated qualitatively and quantitatively measurable impact, building a legacy of success. New and returning countries are encouraged to register for the GM 5.0 to be released in 2026.

Research Progress of Children With Sarcopenia

Zou, Y.F.*

*Capital University of Physical Education and Sports. 17861171152@163.com

INTRODUCTION: Sarcopenia is defined as age-related loss of skeletal muscle mass, loss of muscle strength, and/or decreased physical performance. However, it has been found that sarcopenia can occur in childhood and is often confused with malnutrition, obesity, and metabolic syndrome. In this article, the literature in the field of childhood sarcopenia is compiled and analyzed to provide a reference for determining the progress of sarcopenia research in children. **METHODS:** PubMed and CNKI journal database of China Knowledge Network was used as literature sources for analysis, and the literature on the topic of myasthenia gravis in children and adolescents was searched and downloaded, with the period of PubMed literature for 2013-2023 and CNKI for 2017-2023, and 30 foreign language papers and 1 Chinese paper were finally obtained through manual screening. **RESULTS:** The definition of childhood sarcopenia is unclear at this stage, and there are three main types of sarcopenia based on the etiology of childhood sarcopenia: (1) Reduced skeletal muscle mass in children due to metabolic risk factors such as insulin resistance is called sarcopenia. (2) Imbalance between muscle mass and adipose tissue in children is known as sarcopenia, and lower muscle mass and function than expected for the corresponding age is also a manifestation of sarcopenia. (3) Unintentional muscle loss in children and adolescents due to nutritional deficiencies, physical disorders, and systemic inflammation associated with the disease is known as sarcopenia. Current research on methods to improve sarcopenia has focused on helping groups of children with chronic diseases to improve muscle mass, with little attention paid to subnormal groups of children with low muscle mass. **CONCLUSIONS:** The population of children with sarcopenia is increasingly growing, and we should pay attention to sarcopenia in children for the sake of their healthy development.

Prevalence and Determinants of Low Energy Availability Risk in International Female Youth Footballers

Marshall, Z.A.*, Webb, R.J., Roche, D.M., Alwan, N., Runacres, A.

*School of Health and Sport Sciences, Liverpool Hope University, UK.
marshaz1@hope.ac.uk

INTRODUCTION: Insufficient energy availability can result in adverse health outcomes and is exacerbated by excessive exercise and/or reduced dietary intake. Previous research has focused on endurance, aesthetic and combat sports, but little evidence exists in team-sport athletes. Moreover, the majority of the literature involves adults and has little applicability to adolescent athletes. Therefore, we aimed to determine the prevalence of LEA in international female youth footballers and compare determinants in those at high risk versus those at low risk. **METHODS:** After parental consent, 22 international female footballers (16.7±1.3 years; 164.7±7.8 cm; 61.8±7.1 kg) completed an online questionnaire including self-reported anthropometric measures, training volume and history, LEA in Females Questionnaire (LEAF-Q), and physical activity (PA) and contextual body image surveys. Participants were classified as high

LEA risk (LEAF-Q score ≥8) or low LEA risk (LEAF-Q score <8). Differences in determinants by LEA risk were established using t-tests in SPSS. **RESULTS:** Ten athletes of the 22 surveyed (45%) displayed high risk of LEA and 7 (27%) experienced secondary amenorrhea. However, there were no significant differences between athletes at high and low LEA risk for training load (High LEA risk: 317.7±9.6 hours·year⁻¹ vs Low LEA risk: 368.0±7.4 hours·year⁻¹), amount of moderate-to-vigorous PA. (High LEA risk: 153.9±58.7 minutes·day⁻¹ vs Low LEA risk: 170.5±67.0 minutes·day⁻¹), contextual body image, or any self-reported anthropometrics (all p>0.05). **CONCLUSION:** Almost half of the adolescent footballers surveyed were at high risk of LEA and over a quarter displayed disturbances in their menstrual cycle. The risk of LEA was not associated with training volume or history, PA, or contextual body image. Future research is needed to better understand the mechanistic basis and determinants of LEA in youth athletes to enable maximised performance whilst not impacting upon health.